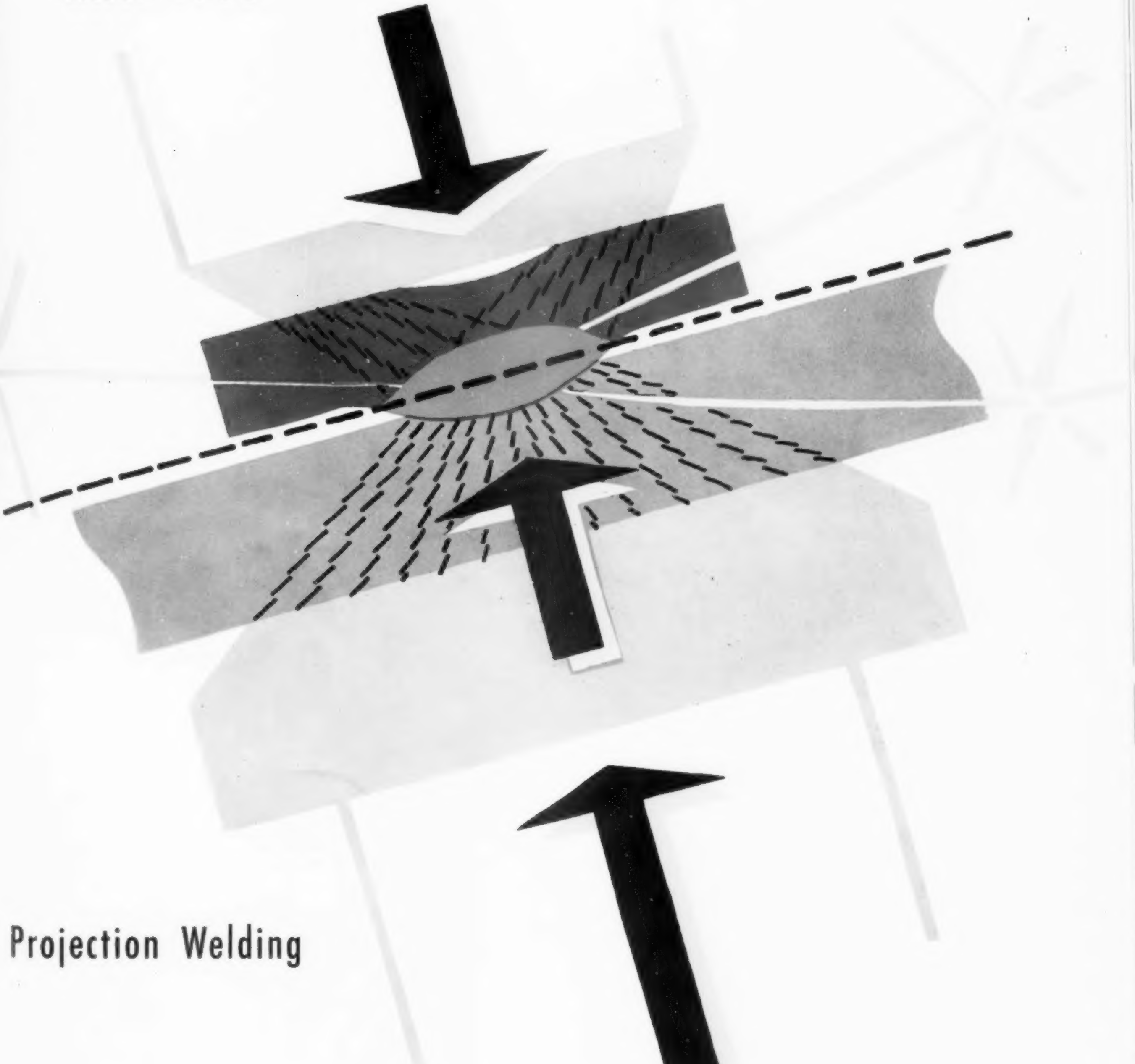
the TOOL ENGINEER

MAY 1955



Projection Welding

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Cov This dramatic pre-
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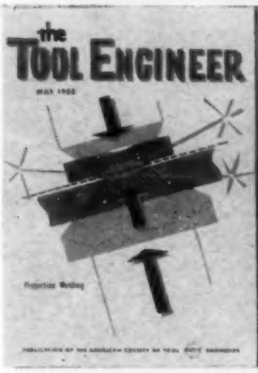

The Tool Engineer

Volume XXXIV, No. 5 **May 1955**

TECHNICAL ARTICLES

ASTE NEWS

DEPARTMENTS

THE TOOL ENGINEER is regularly indexed in the
Engineering Index Service and the *Industrial Arts Index*

ASTE

PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER

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THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $2.00. Non-members, $6.00. Canada, $6.50; all other countries, $8.00 per year.

The Tool Engineer

Behind the Tool Engineer!

Practical experience, invaluable as it is, will not be sufficient for solving tomorrow's production problems. New achievements and developments are being announced at impressively frequent intervals. Without question, methods and processes will continue to be improved and developed at increasing rates. In a period of industrial activity such as this, developments are natural and necessary for survival.

More basic information, however, will be needed by the tool engineer. For instance, if he knew why different tools cut various metals as they do, machinability investigations for a specific job would become unnecessary. If such data were available, he could set up a job for any conditions with certainty. The same would apply with fundamental data on forming, casting, molding and other processes.

Recognizing the need for fundamental data on metal-cutting, the ASTE Research Fund Committee has set up a project to determine if basic theories can be developed and has offered to promote a nationwide study of metal-cutting. Another noteworthy project sponsored by this committee involves the investigation of borides as cutting tools. Many claims have been made but little is generally known. Borides may be as promising as carbides and the possibilities of conserving strategic and expensive materials through the use of boride tools are intriguing.

Also, much has been said of the potentialities of ceramic cutting tools during the past two years. Considerable experimentation has been conducted here and abroad on these unusual materials with varying degrees of success and failure. Results of probably the first successful studies with controlled and predictable methods for cutting steel will be reported in next month's issue.

In addition, many other new developments enable the engineer to be more versatile in his approach to production problems. Forming and drop hammer dies of plastics have simplified many tooling operations. Greater mechanical precision and more accurate controls in machine tools have removed many production bottlenecks. In fact, many machines in the future will incorporate built-in statistical quality control, rendering manual inspection unnecessary. There is no price on ingenuity and the possibilities are limitless.

John W Greve
EDITOR

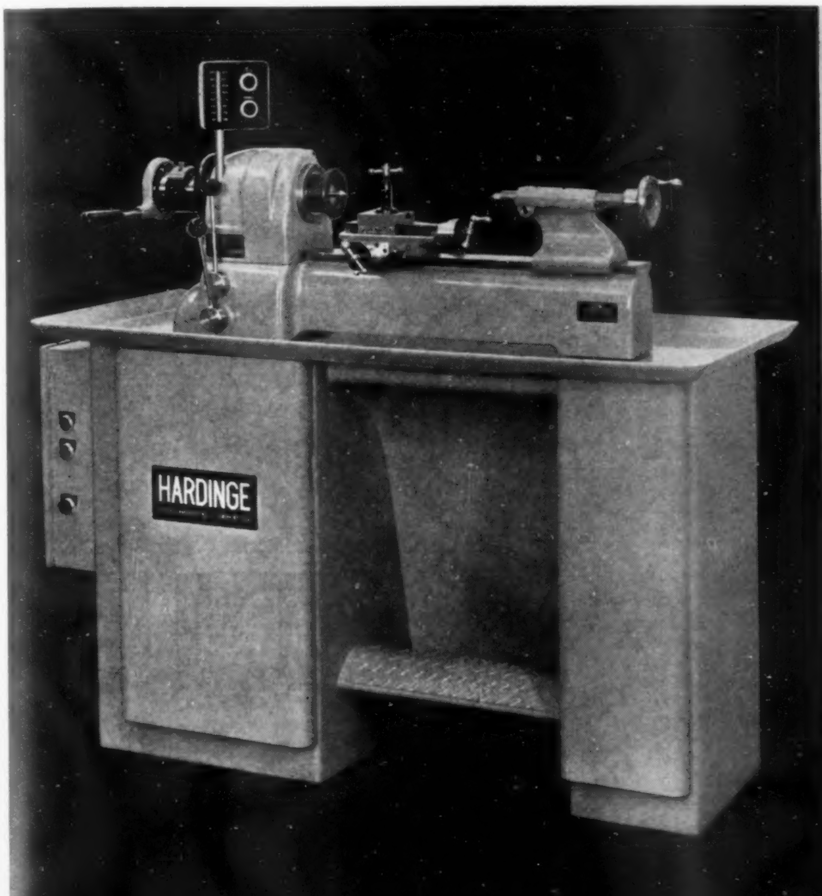
HARDINGE
ELMIRA, N.Y.

NEW Lathe with Variable Speed for Tool Room—Development—Production Work

Simply Push a Button for Exact Spindle Speeds

It's the NEW *Simplified Design*

EASY AND CONVENIENT TO OPERATE



FEATURING:

- Infinitely Variable Speeds 230 to 3500 r.p.m.
- Fast Lever Operated Collet with 1 1/16" Capacity
- Hardened and Ground Steel Dovetail Bed Ways
- Patented Positive Lock Slide Rest
- Full Bearing Tailstock
- And Other Cost Cutting Features

For Complete Information on this Precision Lathe Write for Bulletin DV59

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-5

THE WORLD'S LARGEST

A Demonstration of the LANDIS Thread Rolling Machine

on your workpieces

The new LAN-HY-ROL Thread Rolling Machine offers a combination of precision, productivity, and flexibility in generating external threads unequalled by any other machine now available in the Western Hemisphere. Yet we believe that its superiority is so great that its unlimited potentialities cannot be understood without seeing actual operation.

Therefore, we are offering all manufacturers an operating demonstration of the new LAN-HY-ROL, using your own workpieces if you prefer. Send us the necessary thread specifications and prepared workblanks—we will make the dies required at our own expense, then arrange an operating demonstration here in Waynesboro at your convenience.

408-2C

The new LAN-HY-ROL is based on a rolling system using two circular thread rolling dies and a work support blade. It will produce UNC and UNF threads to tolerances up to and including Class 4, and will also roll Acme, worm, and other special threads. The LAN-HY-ROL will roll threads from 3/16" to 3" in diameter up to 5-7/8" long by plunge rolling, and up to 72" by thrufeed rolling. It can also be equipped for automatic hopper feeding, semi-automatic hand feeding, or rolling special threads between centers.

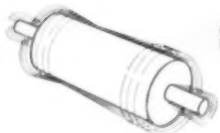
Plan today to investigate the cost-saving advantages of the new LAN-HY-ROL Thread Rolling Machine. Contact us direct in Waynesboro, or through one of our field representatives, about arranging a demonstration.

MANUFACTURER OF THREADING EQUIPMENT—CUTTING—TAPPING—GRINDING—ROLLING

LANDIS Machine CO. WAYNESBORO PENNSYLVANIA

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-9

Why GISHOLT BALANCING stresses "plane separation"



Take this typical part: when you rotate it at high speed, any unbalance effect at one point—or plane—has a "cross effect" in another. If you don't have proper means for separating these unbalance effects in two correction planes, then your balancing job becomes a tedious, time-wasting job of trial and error. And you're never quite sure.

Gisholt Balancers provide plane separation by means of electrical networks. They enable you to use whatever correction planes are most convenient on your specific parts. They let you measure unbalance directly in correction units. They give you the most sensitive, accurate means ever devised—capable of measuring vibratory movement of at least .000025 inch. Gisholts are faster, easier to operate, easier to read. And they make it easy for you to be *sure.*

To have less than these advantages is to add to your costs in other ways—in time, loss of accuracy and inferior balancing standards. Ask us to send the Gisholt Balancing Catalog.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

DYNETRIC BALANCERS

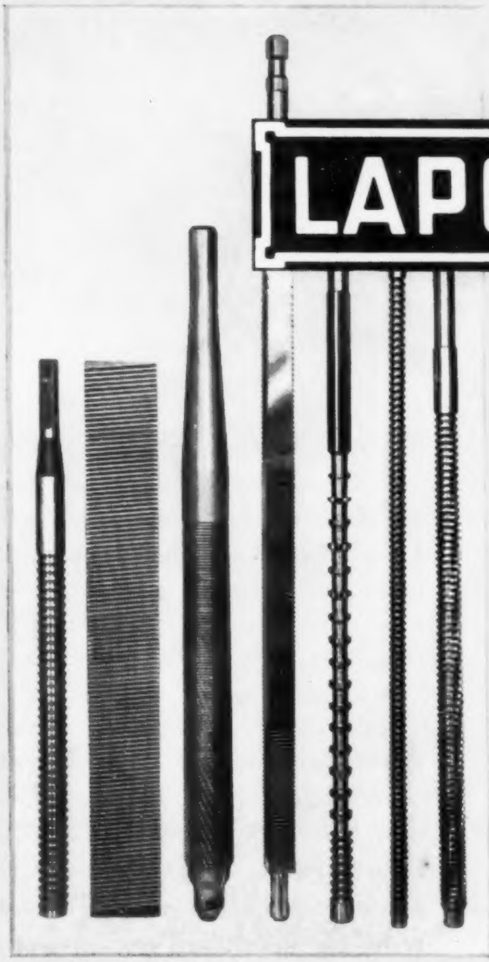
DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

"A broach is a broach is a broach"

...or is it?

Even Gertrude Stein would never have said that, *if she had taken time to investigate the making of*



LAPOINTE BROACHES

Into these broaches goes all the engineering skill, the designing and manufacturing "know-how" of 53 years of broach-making. And not only do we produce the conventional types of surface and internal broaches, but we also get the *hard jobs*, the *really difficult ones!* We are the recognized headquarters, for example, for two extremely important types of broaches:

BROACHES for **involute gears** . . . in the automotive field

BROACHES for **jet engine "pine-tree" forms** . . . in the aircraft field

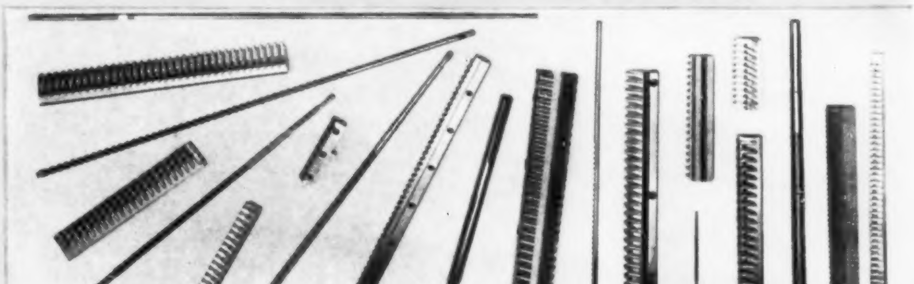
STEEL for all **LAPOINTE BROACHES** is produced under ideal conditions of quality control. Here's what we mean by that:

1. Steel for our broaches is poured to our own proven analysis.
2. Our heats are all poured special.
3. We control the steel all the way — from pouring through heat treating in our atmosphere-controlled electric furnace.

BUYERS OF BROACHES
should consult with us on all their broach problems, for broach grinding is an art — and it has been developed to the highest point of perfection at LAPOINTE.

CARBIDE-TOOTH BROACHES are now a real feature . . . made possible by the extremely high range of broaching speeds on modern Lapointe machines.

Electrolized BROACHES, exclusive with Lapointe, increase life between grinds as much as 2 to 10 times!



THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

HUDSON LAPOINTE MASS

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

praise from Caesar...

The Salt Lake Tribune, Sunday, June 20, 1954

Here's the New McGee and Hogan

Radial Drilling Machine

With its 5-foot arm, this modern machine is capable of driving a 3" diameter drill to capacity through the center of a 10-foot diameter solid steel work piece. Also used for tapping and large boring operations, it is the only really modern radial of such dimensions in any intermountain machine shop doing repair work.

Veteran operator Pat Langford, above, finds the centralizing of all controls on this machine a big advantage over old-fashioned, scattered control points. Time saved means lower costs per job.

McGEE & HOGAN
MACHINE WORKS
1154 South 2nd West - Salt Lake City - 84-5291

When a customer of such outstanding caliber and recognized reputation as the McGee & Hogan Machine Works of Salt Lake City, Utah spends his own good money to tell the world how good his new "AMERICAN" Hole Wizard Radial is that's really "Praise from Caesar."

The accompanying McGee & Hogan advertisement appeared in the Sunday, June 20th, edition of The Salt Lake Tribune. It shows the new 5' 13" "AMERICAN" Hole Wizard Radial at work in their plant producing work for customers at "lower costs per job."

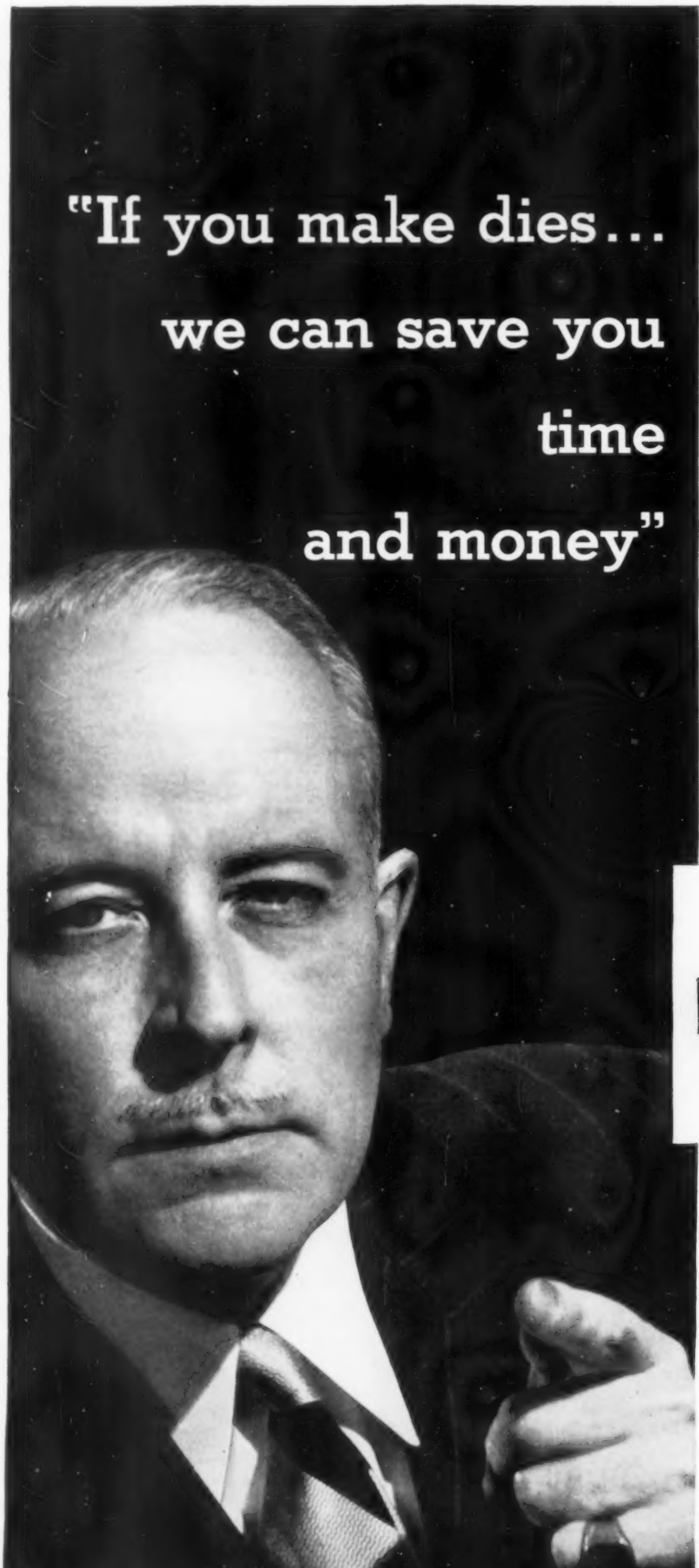
Lots of power, wide range, convenient controls and plenty of ruggedness are doing for McGee & Hogan Machine Works exactly what "AMERICAN" Hole Wizard Radials will do for you.

And Mr. Ray Hogan adds another punch to this testimonial by telling us in a recent letter, "Your machines are doing a wonderful job for us."

Send for bulletin No. 327 and get the facts.

THE AMERICAN TOOL WORKS CO. Cincinnati, Ohio U.S.A.

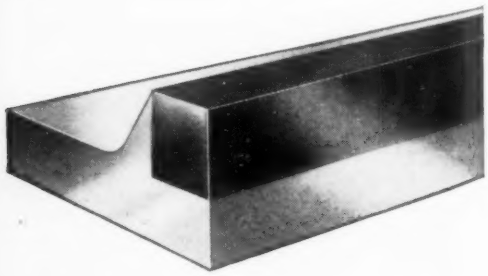
Lathes and Radial Drills



You save time because OK Composite Die Sections are carried in stock ready for immediate shipment to you. They are available for Cutting, Trimming and Forming Dies. You can order them cut to length or in bars 125" long. There are 11 standard cross sections with both wide and narrow lands.

You save money because you can buy them at a price far below what it would cost you to make them yourself. And the soft steel backing, to which uniformly hardened steel is clad, is drilled quickly and economically for dowel and screw holes. Adjustments for wear are equally simple.

Companies now using OK Composite Die Sections report great time and money savings over competitive products formerly used.



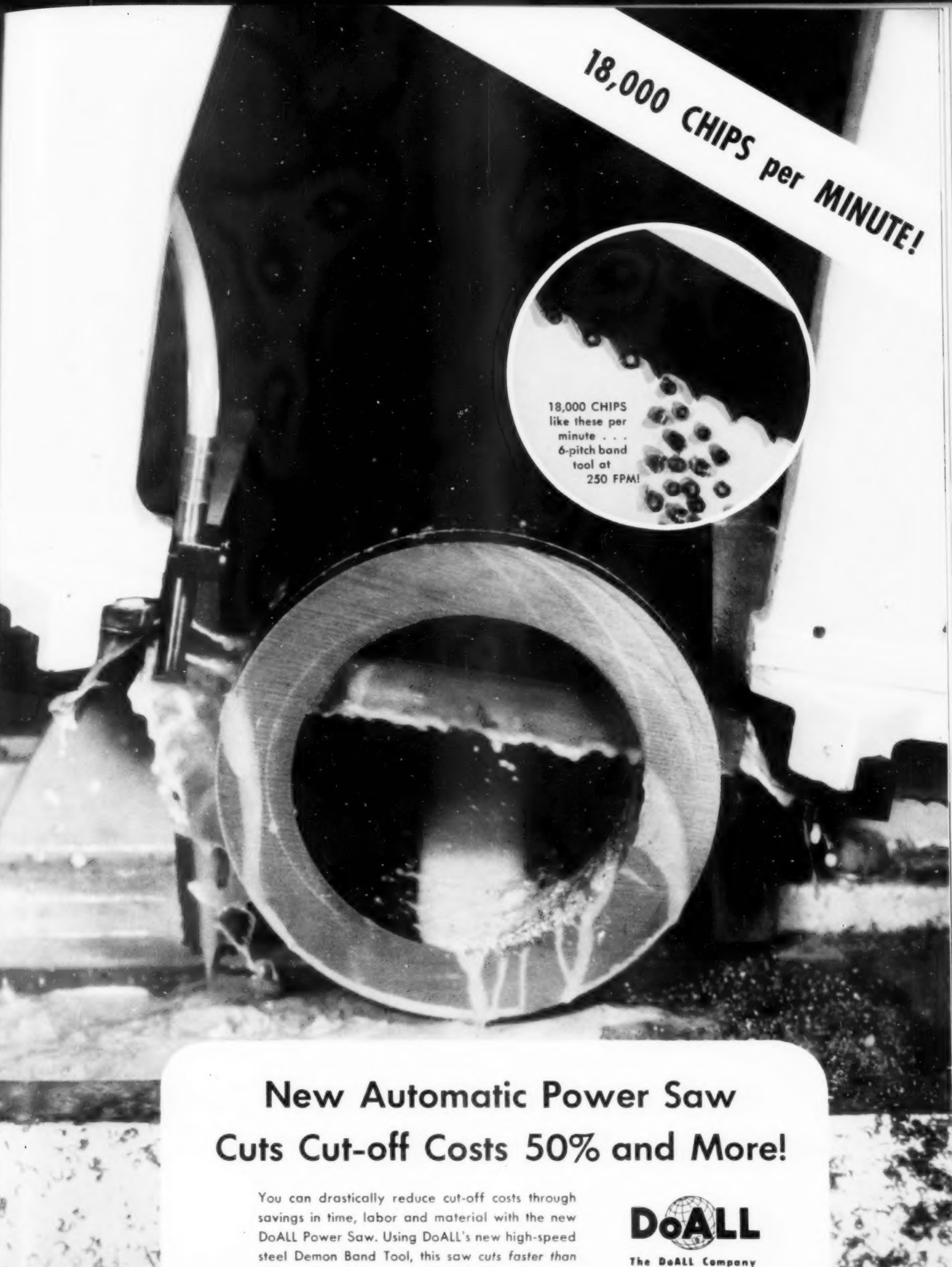
You'll be interested in receiving FREE a new Bulletin on OK Composite Die Sections and Clad Aluminum Bronze Wear Plates. Write Dept. 42-U.

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

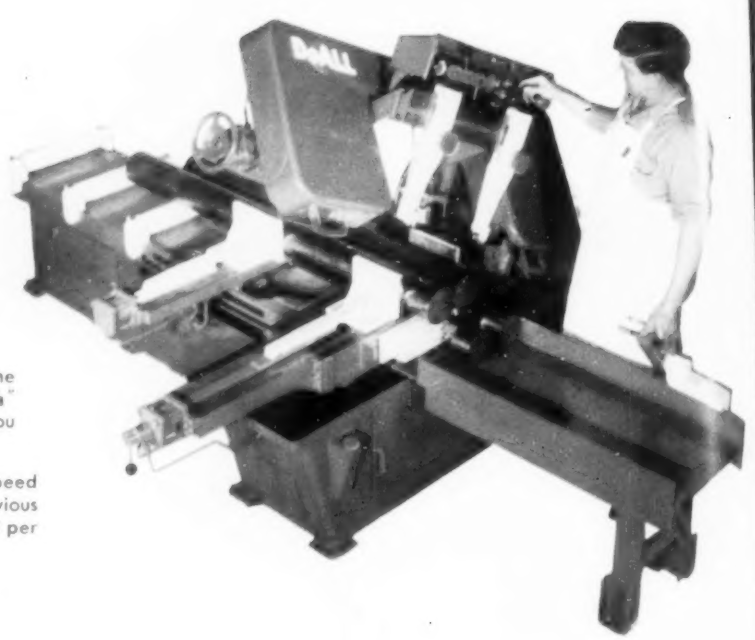
Manufacturers for the Metal Working Industry of:

Slitter Knives • Shear Blades Work Rest Blades • Cut-Off Blades • Hardened Spacers Hardened Ways • Gibs • Ball Races • Bronze Ways Wear Strips


18,000 CHIPS per MINUTE!
18,000 CHIPS like these per minute . . . 6-pitch band tool at 250 FPM!
New Automatic Power Saw
Cuts Cut-off Costs 50% and More!
You can drastically reduce cut-off costs through savings in time, labor and material with the new DoALL Power Saw. Using DoALL's new high-speed steel Demon Band Tool, this saw *cuts faster than any other machine in the world* of comparable price and capacity, including power hack saws.
DoALL
The DoALL Company
Des Plaines, ILL., U.S.A.
. . . turn the page for details.

NEW
MACHINING TEAM

DoALL Power Saw . . . Outperforms All Others!



- ★ CUTS FASTER—cuts 25% to more than 50% faster than power hack saws of comparable capacity and price . . . pays off fast in labor savings and higher output per machine.
- ★ SAVES MATERIAL—just compare the 1/16" kerf cut by the thin, continuous cutting DoALL band tool with the 1/8" kerf of hack saw blades or 1/4" cut of a cold saw . . . you save 1/2" or more of costly stock every 8 cuts!
- ★ LOW TOOL COST—the new DoALL Demon High-Speed Steel band tool lasts up to 10 times longer than previous carbon steel saw bands . . . you get tremendous output per dollar of tool cost!
- ★ CAPACITY UP to 12" rounds, 12" x 12" flats.

You can put a terrific cutting load on a Demon Blade—*a continuous band of high-speed steel.* It retains its hardness up to 1100°F compared to only 350° for carbon steel blades. Available in Precision and Buttress type . . . in welded bands to fit the DoALL Power Saw . . . 1" wide . . . 2 to 10 pitch depending on material to be sawed.

THE new DoALL Power Saw and DoALL Demon high-speed steel band tool is the most productive cut-off team ever developed. *Continuous* high-speed cutting . . . stock-saving narrow kerf . . . great accuracy . . . straight cuts . . . good finish . . . automatic operation . . . minimum floor space . . . hydraulic controls . . . easy operation . . . low maintenance—all these and more cost-reducing benefits accrue to its users.

FULL AUTOMATIC or MANUAL FEED—models available with fully automatic feeding, indexing and sawing for high volume production, or with manual feed when desired.

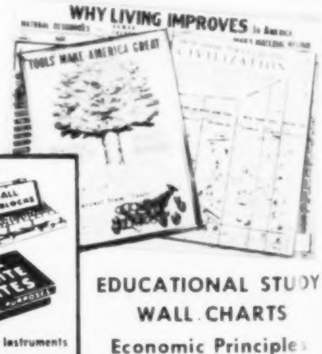
VARIABLE SPEED—90 to 350 FPM for greatest sawing versatility and efficiency. Step or single speed drives optional.

CONSTANT BAND TENSION AND FEED PRESSURE, automatically maintained for optimum sawing efficiency.

To cut your cut-off costs, get the facts . . . then judge for yourself!

DoALL

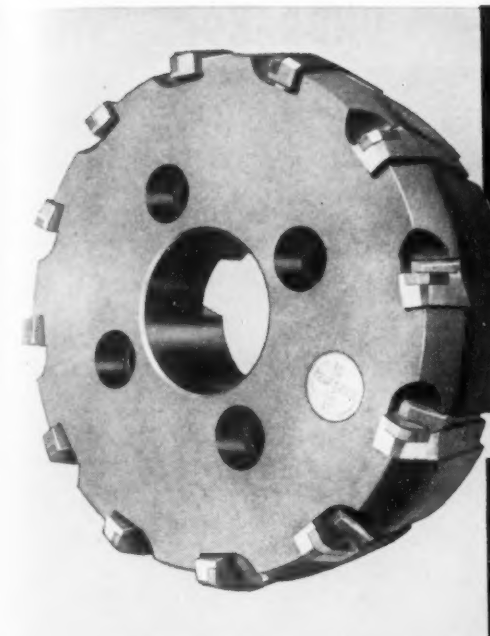
FREE DEMONSTRATION. *You can see it and believe it! Call your local DoALL Store or write DoALL, Des Plaines, Ill., for a free demonstration at your plant on your work. And, ask for new Catalog.*



Friendly DoALL Stores . . . (in 40 cities)

Personalized Service . . . Complete Stocks . . . Local Delivery

EDUCATIONAL STUDY WALL CHARTS
Economic Principles
$1.00 each postpaid
Lower quantity prices.

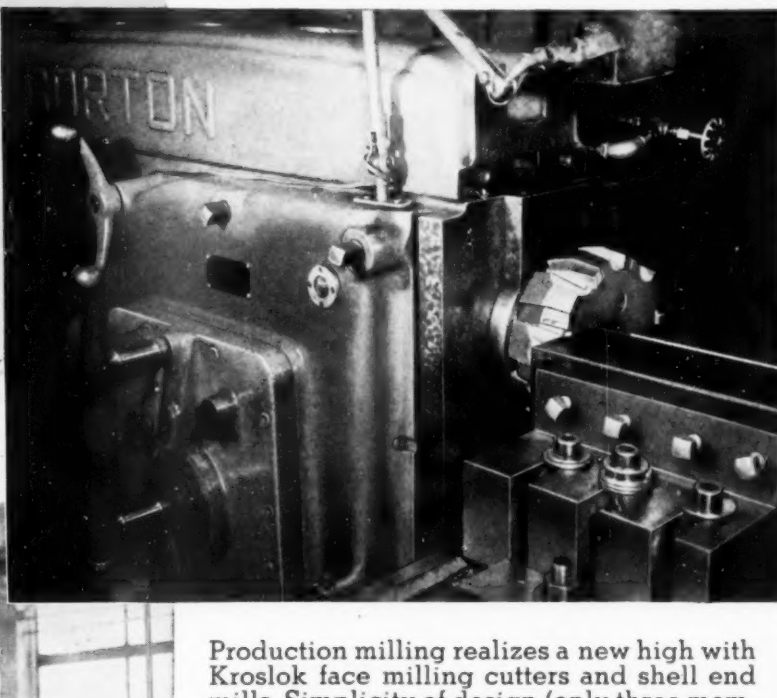


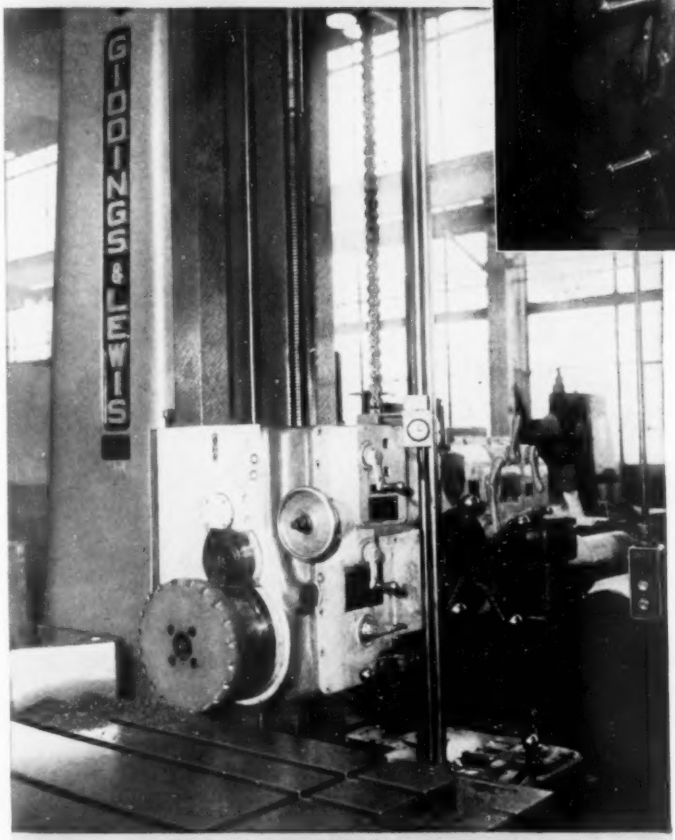
KROSLOK® MILLING CUTTERS

GROUP IMPORTANT CONCEPTS FOR *Higher Production*

TOP FEEDS AND SPEEDS — RUGGED RIGID — ONLY 3 MEMBERS

Where heavy cuts are the rule, Kroslok performs long and profitably.





Production milling requires "tops" in production tools.

Production milling realizes a new high with Kroslok face milling cutters and shell end mills. Simplicity of design (only three members), extreme ruggedness and rigidity, merit your thorough investigation. Kroslok is available in general purpose and heavy duty types for ferrous or non-ferrous metals, with both fine tooth and extra fine tooth variations, in diameters from 3" through 24". May we suit Kroslok's advantages to your job?

THE MOTCH & MERRYWEATHER MACHINERY CO.

CUTTING TOOL MANUFACTURING DIVISION

CLEVELAND 17, OHIO

Stocking Dealers in All Industrial Centers

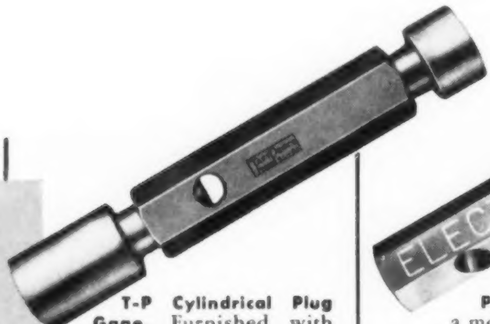
TRIPLE-CHIP CIRCULAR SEGMENTAL AND SOLID CUT-OFF BLADES • TRIPLE-CHIP SLITTING SAWS • TRIPLE C GRINDING COOLANT • TRIPLE-CHIP SOLUBLE OIL

TIPS FROM TAFT-PEIRCE ON:

How to cut FIXED GAGING COSTS

Picking the *right* gage for each job can result in substantial savings — in gaging time, upkeep, replacement and initial cost. Here are some comparisons that will help you to make your selection.

Plain Plugs



T-P Cylindrical Plug Gage. Furnished with "Go" and "Not Go" separately, or on opposite ends of handle. Progressive gage — with "Go" and "Not Go" on same end increases speed.

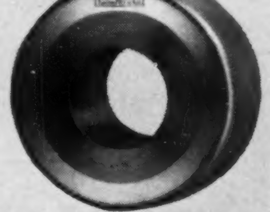
T-P Electrolized Plug Gages. With only a modest increase in initial cost, substantially longer wear life can be obtained with this exclusive surface treatment. Many users report up to 3 times longer gage life.

T-P Carbide, Norbide, and Chromium Plated Plugs. For exceptional resistance to abrasion or scratching. Maximum wear-life. Brittleness requires care in handling.

Plain Rings

T-P External Ring Gage. For reference purposes, setting air or other variable gages and accurate size control of parts.

T-P Chromium-Plated Ring. Lowers gaging costs on longer runs of highly abrasive materials or hardened steel. Provides up to 5 times more service.

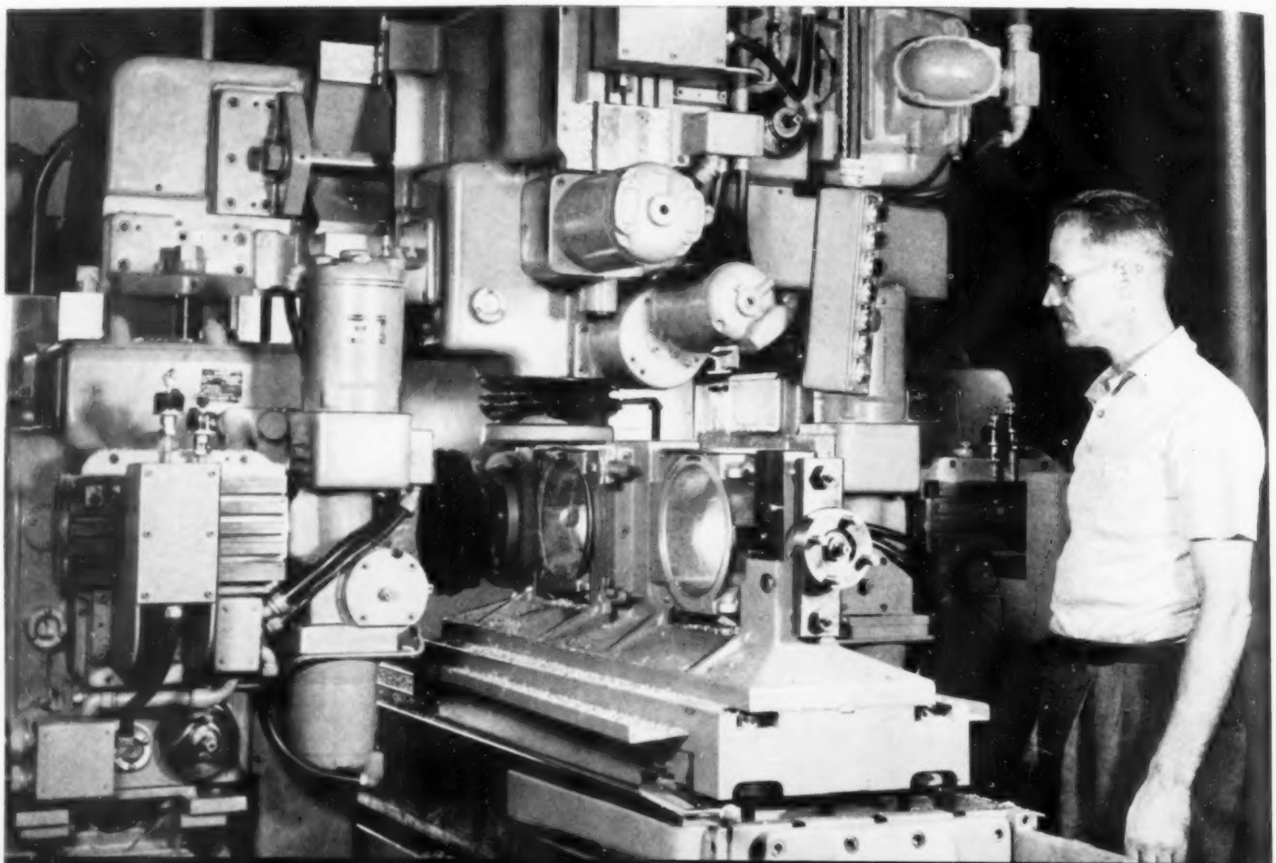


T-P Norbide and Carbide Rings. For greatest wear-resistance. Available in Norbide and Tantalum or Tungsten Carbide. Brittleness requires careful handling.

THE TAFT-PEIRCE
WOONSOCKET,


Adjustable Snaps
T-P Plain Adjustable Snap Gages. Available with gaging pins, round or square buttons, and solid anvils in combination with buttons.
T-P Midget Snap Gages. Smaller in size and section, their light weight aids in gaging small or delicate parts. Maximum rigidity and stability are provided.
T-P Cemented Carbide or Norbide Snaps. For close tolerance work on abrasive materials. Gaging members tipped with Tungsten or Tantalum Carbide. Or with Norbide inserts, as shown.
Thread Plugs
T-P Limit Thread Plug Gage. Available in Taper Lock or Trilock design. Taper Lock up to 1.510". Reversible from No. 0 to ½". Reversible Trilock above 1.510".
TAFT-PEIRCE MFG. CO.
T-P Carbide Thread Plug Gage. For longer wear. Furnished both standard and special from #8 machine screw size up.
T-P Truncated Thread Set Plug Gage. Sets and checks thread gages with greater accuracy. Checks thread angle and O. D. Indicates wear, or oversize.
Thread Rings & Snaps
P.G. 7049
¾-16 N.F.
T-P Thread Ring Gages. Single unit clamping device simplifies setting, increases accuracy, eliminates distortion. Locks without changing pressure on ring.
T-P Adjustable Thread Snaps. Faster than ring gaging, and just as accurate, they check lead, angle, and all other thread elements. Variable pitch diameter.
T-P Roll Thread Snaps. Same as Adjustable, with *rolls* for gaging members. Since gaging members rotate, wear is spread over greater surface and service life increased.
Special Gages
T-P Rotochek. Fastest thread gaging method. Push — and the gage screws into the work. Release the pressure and it stops. Pull — and it disengages.
T-P Spline Gages. A special gage due to the diversity of individual requirements. Thousands of such special gages are made at Taft-Peirce every year.
T-P Thread Concentricity Gage. Checks size and location of internal threads. Another example of infinite variety of fixed gages made by T-P.
Gage Blocks
T-P Gage Blocks. For the ultimate in accuracy. Measures increments down to 0.00005". Available in small or large sets, or individually. Carbide Wear Blocks also available.
T-P means Top Precision
T P
MANUFACTURING COMPANY
RHODE ISLAND
For the complete story on these items, and many more, get your copy of the new Taft-Peirce Handbook.

News



ANOTHER EXAMPLE OF SUNDSTRAND "ENGINEERED PRODUCTION" . . . .

Production Increased from 45 to 110 Pieces Per Hour

Here's another interesting example of the effectiveness of Sundstrand "Engineered Production" as applied to a milling problem. This Sundstrand Triplex Rigidmil mills 3 surfaces of cast iron gas meter bodies at the rate of 110 pieces per hour.

The drawing on the opposite page illustrates the arrangement of the three cutters. The fixture holds two pieces and can be pivoted so that one piece can be milled while another piece is

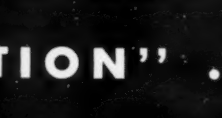
SUNDSTRAND

50 YEARS OF "Engineered Production Service"*

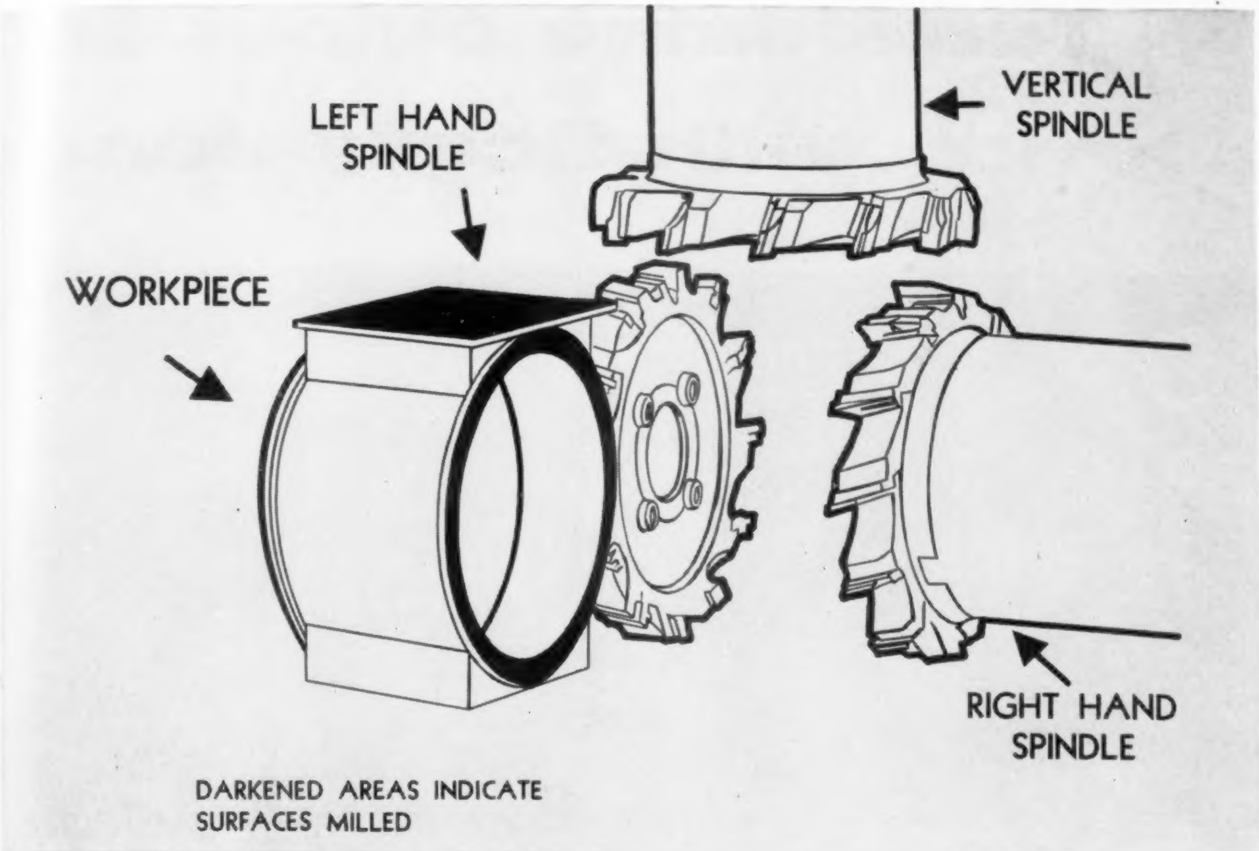
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES

SIMPLEX RIGIDMILS



DUPLEX RIGIDMILS



loaded in the opposite station. With this arrangement loading time is free.

Previous production of 45 pieces per hour was obtained from two milling machines with two operators. The Triplex produces 110 pieces per hour with one operator. If you have milling work of this nature investigate the possibilities of the Sundstrand Rigidmils.

For practical solutions to your milling problems use

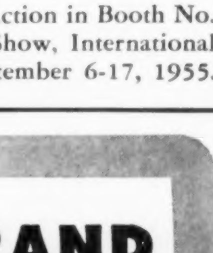
SUNDSTRAND

"Engineered Production"

SERVICE. This is but one of countless milling production problems solved through the use of Sundstrand "Engineered Production". For further information about this service call in a Sundstrand engineer. There is no obligation for this service.

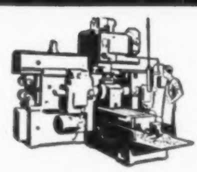
more facts

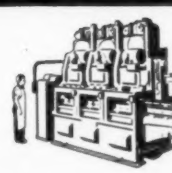
about milling production are contained in this booklet. Write for your copy today. Ask for bulletin 755.



See Sundstrand machines in action in Booth No. 1412 at the Machine Tool Show, International Amphitheatre, Chicago, September 6-17, 1955.

TRIPLEX RIGIDMILS | **SPECIAL MACHINES**

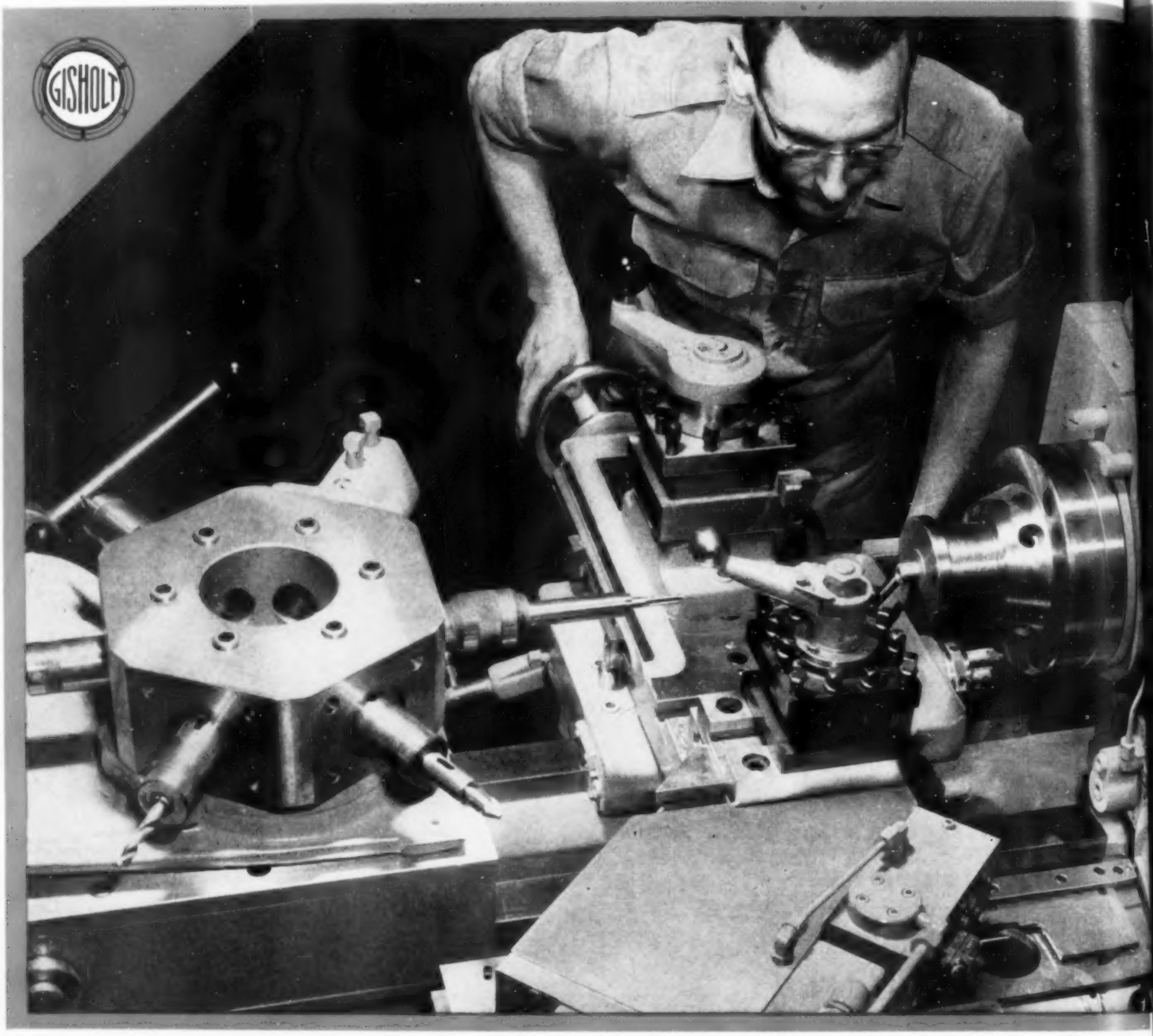




SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

Turret lathe output and

with Scully-Jones



SCULLY JONES

"Precision Holding" solves diversified tooling problems on Gisholt Turret Lathe

This Gisholt No. 5 Ram Type Turret Lathe—a machine that's truly easy to operate—is equipped with hydraulic tracer and nine different Scully-Jones "Precision Holding" Tools in the hex turret (for two setups). It will be exhibited by Gisholt Machine Company in Chicago next September at the Machine Tool Show—Booth No. 1413.

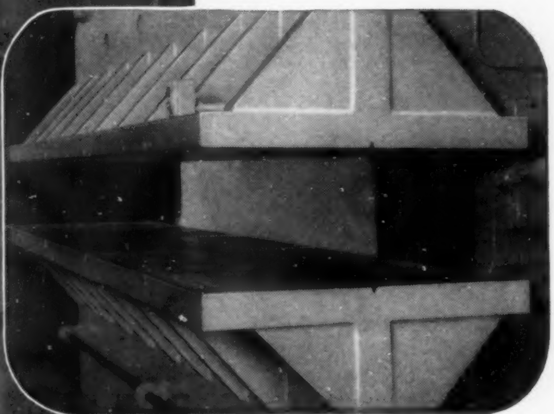
See this exciting demonstration of accuracy and high production on a Gisholt Lathe performing 11 diversified operations on two ends of Scully-Jones Shell End Mill Arbors.

 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-31

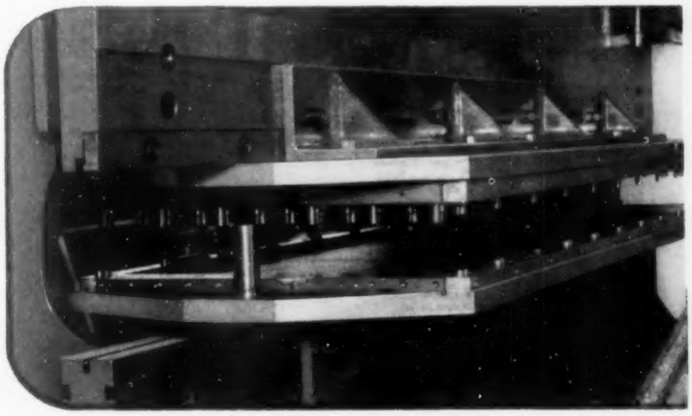
areas . . .

on Cincinnati Press Brakes

More and more jobs are being done on versatile Cincinnati Press Brakes. Removable or fixed brackets with large die areas permit many jobs to be done both in the Press Brake and Press fields. When dual purpose performance is required removable brackets are used—for Press work only, fixed brackets are furnished. Brackets are designed to sizes desired.



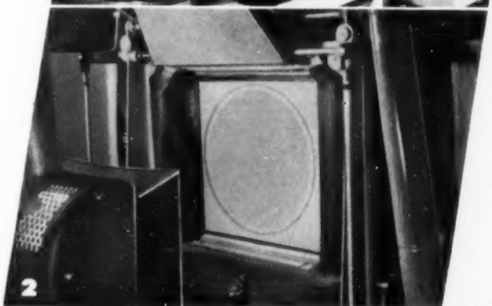
• Large area, permanent wide bed and ram for press work.



• Large area, removable upper and lower brackets.

Investigate! **Our Engineering Department will be glad to advise you on the profit and production possibilities in your shop. Write for Catalog B-4.**

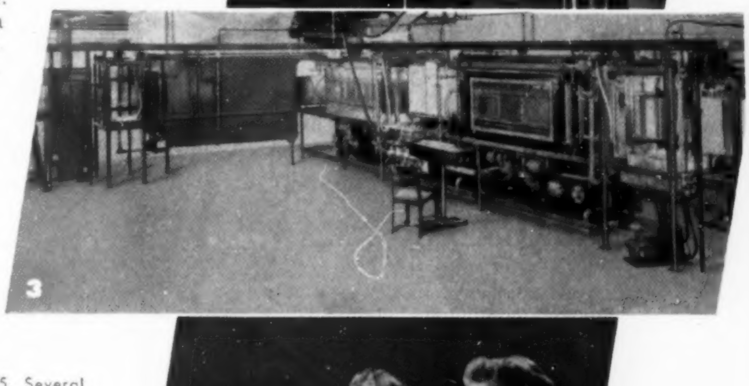
Color TV came to ANACONDA



When the television industry needed a shadow mask to control electron beams in the color tube, Buckbee Mears Company, photoengravers of St. Paul, Minnesota, produced it. When they needed thin strip metal in which 2500 perfect holes per square inch could be etched, Anaconda produced it.

When color TV came to Anaconda, we developed a new alloy, 6% Cupro Nickel, with such uniform quality, structure and thickness (0.0075") that the microscopic holes could be etched without flaw. The new alloy also has the strength and malleability to take forming without distortion of the dot structure, and functions in a color tube without contaminating the vacuum.

Again, a copper alloy has solved a difficult problem. Perhaps yours can be made easier through Anaconda research and development. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.



1 Rolls of the Cupro Nickel strip entering coating machine to be sensitized for photographic printing.

2 Camera printing dot pattern on the sensitized Cupro Nickel strip.

3 Printed Cupro Nickel strip at right entering etching machine where acid baths plus washing and rinsing operations produce finished mask.

4 Each 19" shadow mask has more than 400,000 holes, size .010 ± .0005. Several areas of screen are inspected electronically to check hole size.

ANACONDA the name to remember in

COPPER • BRASS • BRONZE

TOOLMAKERS..MACHINISTS..APPRENTICES..STUDENTS..MANUFACTURERS..MACHINE SHOPS

NEW "DOIT" URSLF PRECISION TOOLS

Slash the cost of toolmaker's tools!

and make possible greater earnings for metal workers... greater savings for the companies that employ them!

do better work! get better pay!

Could you do better work if you owned better tools? Of course you could! You'd get better pay! That's why "DOIT" URSLF is so important! Up to now you may not have felt you could afford to buy such tools as these. But "DOIT" URSLF, a remarkable new approach to the manufacture of toolmaker's tools, cuts costs to the bone . . . allows you to own the very finest tools for pennies where otherwise you'd have spent dollars.

The "reason why" that makes these tremendous savings possible is simple:

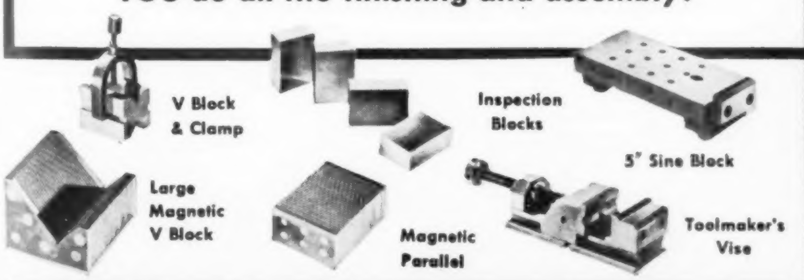
"DOIT" URSLF furnishes all materials!
"DOIT" URSLF gives you complete drawings and instructions!
YOU do all the finishing and assembly!

cut costs! cut labor! cut "down" time!

The cost-conscious machine shop or manufacturer will find hundreds of special applications for "DOIT" URSLF tools that will save time and money and add to the flexibility of expensive machinery.

The variety of magnetic tools, alone, offered by "DOIT" URSLF, will be impressive.

Assembling and finishing any "DOIT" URSLF tool is simple—even for a student or apprentice.



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Mail this coupon! You may paste it on a postcard if you wish!

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Please send me the FREE "DOIT" URSLF Precision Tool Catalogue.

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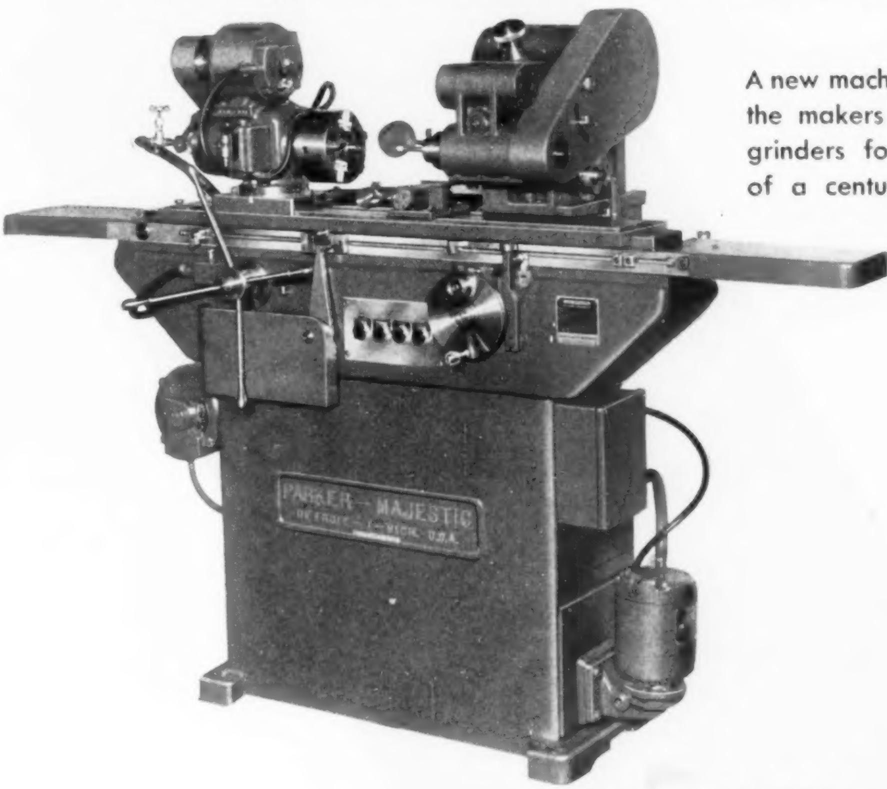
PHONE—Gladstone 5-5200

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-37

PARKER • MAJESTIC **pm** PRECISION MACHINES

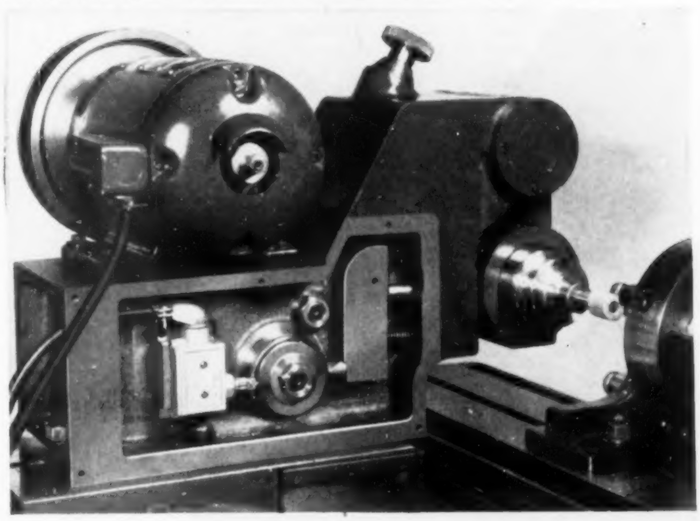
THE SEMI-AUTOMATIC INTERNAL GRINDER

Surprisingly Low in Cost with Greater Production



A new machine developed by the makers of fine precision grinders for over a quarter of a century.

AUTOMATIC SPINDLE IN-FEED-CAM ACTUATED



Automatic sizing unit sufficiently versatile for production of one of many pieces. Accurately repeats on additional pieces after completing finished size set up on first piece. Available on either 12″ or 24″ table travel machines.

Table travel is accomplished by any one of three methods.

1. **HAND FEED**
2. **RECIPROCATOR**
3. **POWER FEED MECHANISM**

Write for Illustrated Folder

See *the* **PARKER-MAJESTIC exhibit** (booth No. 415) at

THE MACHINE TOOL SHOW
CHICAGO, ILL.
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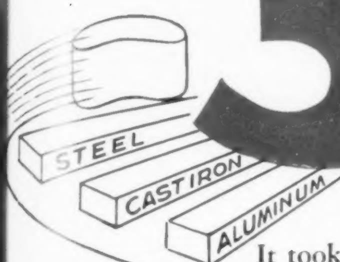
PARKER-MAJESTIC, Inc.

147 JOS. CAMPAU AVE. DETROIT 7, MICHIGAN

WITH 1 "SPEC"...

3 METALS!



It took BAY STATE segments *and* engineering to lick this problem for a New England manufacturer! Distributor abrasive engineer Jack Somers did it, and gave the customer *extra* values too.

Here's how this problem was solved

Gear blanks, timing gear cases, transmission housings and other products . . . some of steel (both hardened and soft), some of aluminum, and others of cast iron . . . all had to be faced on rotating-table surface grinders. Obviously, savings could be made *if* the same set of segments could satisfactorily grind and finish all three metals.

Mr. Somers, using his specialized technical knowledge, proved it *could* be done . . . with the BAY STATE 8A-301G8-V2 specification.

Results: Cutting Action: EXCELLENT, on all three metals.

Segment Life: MORE THAN DOUBLE that of competitive specifications.

An *extra* value was the low cost of the "8A" abrasive, BAY STATE'S economy abrasive mixture which gives premium cutting characteristics at non-premium price.

Bay State can solve your grinding problems

Grinding gear case. Note how strobo-flash photo stops motion of coolant

Request BAY STATE'S free, "On-The-Job" engineering service (see coupon below), available through your local distributor, our district offices, or from Westboro.

This top-flight engineering service plus all the BAY STATE product superiorities, such as Fractional Grades (3 degrees of hardness within a single normal grade), Controlled Porosity, and the economy abrasive "8A" can bring about the solution to your grinding problems.

BAY STATE

WHEELS of PROGRESS

MAIL COUPON TODAY

Please send us Surface Grinding literature. ☐

We have a grinding problem. Please have a representative call. ☐

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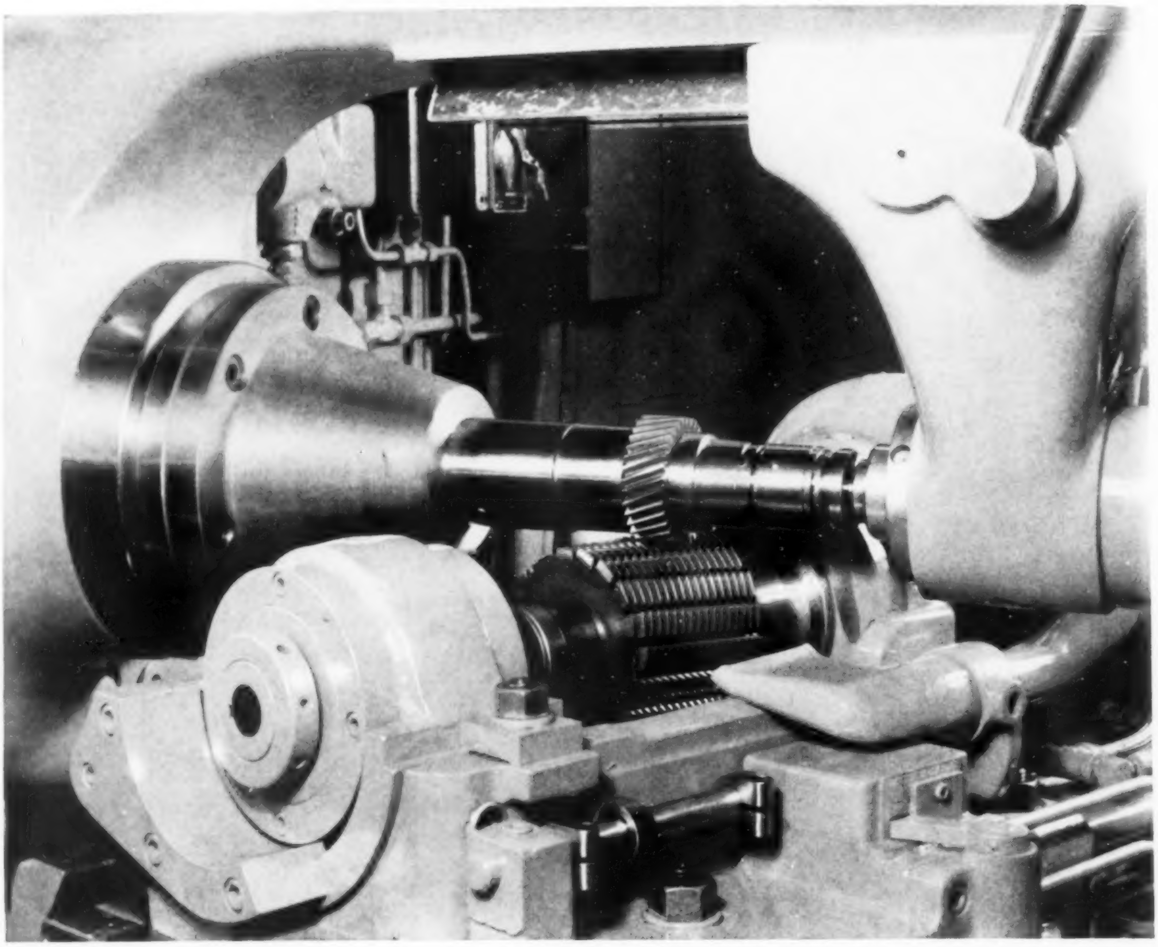
GISHOLT
whatever
your turning problems
may be...
GISHOLT
is ready to help you increase production
GISHOLT MACHINE COMPANY
MADISON 10, WISCONSIN
THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.
GISHOLT
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



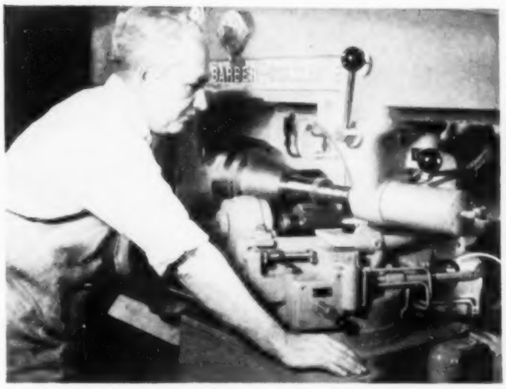
HIGH-SPEED HOBBING

INCREASES PRODUCTION AND TOOL LIFE

The Barber-Colman No. 14-15 Hydraulic Hobbing Machine is being used in several plants for hobbing of steel gears at speeds of approximately 300 SFM with an increase in both production and tool life. Although these speeds have not been considered practical until recently, the size, power and rigidity of the No. 14-15 Machine make it ideal for high-speed hobbing. Even with a standard hob slide, speeds of 300 SFM with a 5" hob are possible. However, most machines for high-speed hobbing are equipped with a special tapered roller bearing hob slide.

The high-speed hob slide is capable of speeds up to 700 RPM and is designed to accommodate hobs up to 6" diameter. This slide provides the rigidity to maintain accuracy at high speeds. It is equipped with precision tapered roller bearings. An automatic hob shifter may be furnished as extra equipment. Feeds up to 6" per minute are available for use with high speed slides. High-speed hob slides and gears for higher feed rates may be installed on recent machines in the field. For speeds over 700 RPM another hob swivel assembly is available.

BUILDERS OF PRECISION GEAR



The jobs shown here indicate at least 200% increase in production, 100% better tool life, greater profile accuracy and equal or improved surface finish on the hobbed gears, hobbing at speeds of 300 SFM or greater. Using ground and unground hobs, gears were cut from a wide range of steels as high as 207 Br. hardness.

FIRST SERIES OF TESTS

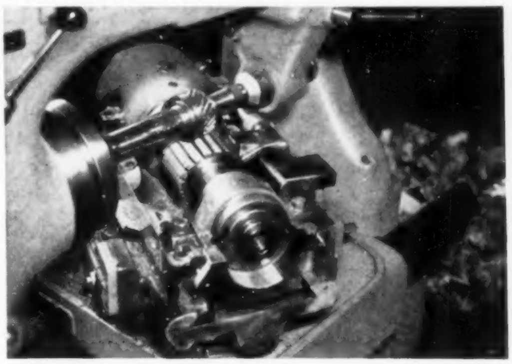
GEAR		STANDARD HOB SWIVEL		HIGH-SPEED HOB SWIVEL		% INCREASE	
DP	No. Teeth	Cutting Time at 135 SFM	Pieces Per Shift	Cutting Time at 326 SFM	Pieces Per Shift	Prod.	Tool Life
6	36 Spur	10.64 min.	72	4.2 min.	161	153%	123%
6	35 Spur	11.62 min.	72	4.5 min.	151	158%	109%
8	55 Helical	15.14 min.	50	6.94 min.	105	118%	110%
8	62 Helical	26.8 min.	28	10.3 min.	72	160%	157%

Double Thread Hob, 5x5x2 — Feed — .060"/rev.
Steel — AISI 8620 normalized — No difference in surface quality
Profile and lead angle above average accuracy

SECOND SERIES OF TESTS

HOB	GEAR	SPEED	FEED
Accurate Unground 9 D.P. 3-Thd. 5x5x2	22 Teeth, Helical SAE 5135 170-207 BHN	307 SFM	.045"/rev.
Same	Same	307 SFM	.070"/rev.

Climb Hobbing
Material — AISI 5135
Average lead error—at .070" feed within .0006" in 13/16"
Total Composite Error—.002" both feeds
Estimated Hob Life—200 per sharpening
Using same speed and feeds with conventional hobbing, resulting finish was not as good.



Although high-speed hobbing of steel gears is not used extensively as yet, it is used on enough jobs to prove that it is applicable under the proper conditions. Tests indicate that tool life increases until a speed of 200 SFM is reached, and then drops off rapidly to a speed of 250 SFM. After 250 SFM, however, hob life increases again until it is equivalent or better at 300 SFM than at 200 SFM. Materials on which satisfactory results have been produced include AISI 1113, 8620, 5135 and 4140.

Our Engineers have been working with our customers on high-speed hobbing and have helped to solve many problems. They will be glad to discuss the economy of high-speed hobbing to your specific job if you will submit your part print and production requirements to them.

Call your Barber-Colman representative or write direct to:

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 635 ROCK STREET, ROCKFORD, ILLINOIS

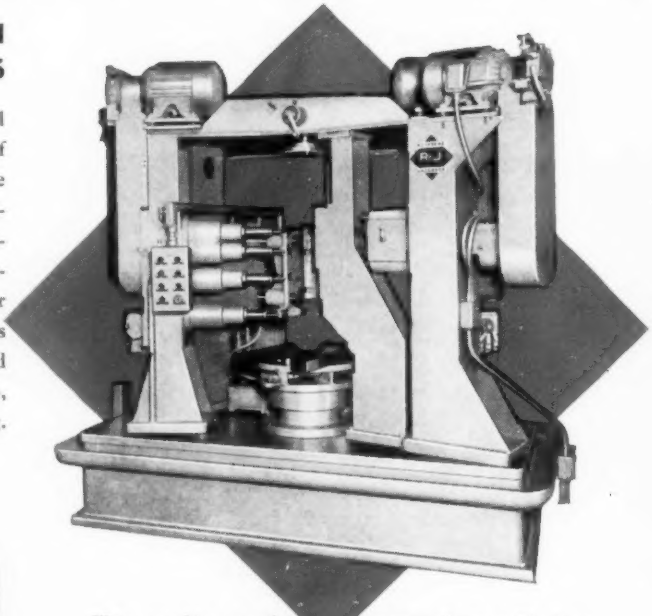
HOBS AND MACHINES SINCE 1911

Rehnberg-Jacobson

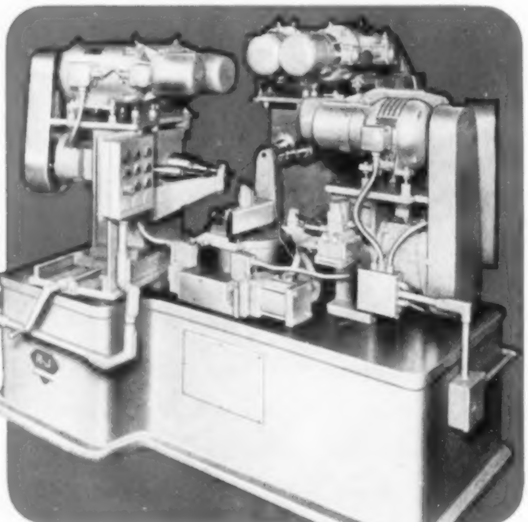
TWO-POSITION RECIPROCATING INDEX MECHANISM HAS ADVANTAGES ON CERTAIN TYPES OF WORK

PERMITS ECONOMICAL APPLICATION OF PRODUCTION MACHINE TOOLS

We have built a number of machines of the type illustrated here, which have enabled the users to enjoy the economies of machine-tooled production at a moderate cost. Usually the pieces have required a two-operation procedure, such as drilling and reaming or drilling and tapping. The distinctive feature of the machines is a two-position automatic index arrangement. The piece is loaded at station one and the operator pushes a button to obtain the fully automatic cycle: spindles advance and retract at station one, the fixture is indexed say 15° or 20°, spindles advance and retract at station two, then the fixture is indexed back to station one for unloading.



This machine performs two operations with four spindles each from the left-hand column, and two operations with two spindles from the right-hand column.



On this machine, three oddly-placed holes are drilled and tapped. The left-hand head is mounted on ways with adjustment for different work pieces.

SMALLER MACHINES COST LESS THAN MULTI-STATION UNITS

This kind of work is often laid out for large multiple-station machines with a continuous-sequence arrangement and possibly fewer spindles at each station. The reciprocating-index machine offers the advantages of lesser floor space and lower cost. It is particularly advantageous where the piece may not call for full-time production. In comparison with producing the piece on standard machines, all the benefits of production-machine tooling are, of course, achieved. A wide variety of arrangements are possible, depending on the work to be done, using drilling, tapping, reaming, boring, milling, and other tooling as needed. *Let us quote on your potential requirements.*

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

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PUTNAM END MILLS

Produce Finer Finishes

Noted For Fast Free Cutting on toughest metals at heavy feeds and high speeds, Putnam End Mills produce smooth accurate cuts having exceptional finishes that often eliminate all grinding or hand finishing.

Your toughest milling operation is an opportunity to prove the unusual superiority of Putnam End Mill design and manufacture. Select from over 1200 sizes and types of standard Putnam End Mills the one for your job and then watch it more than meet the challenge with faster, smoother cutting.

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2981 CHARLEVOIX AVE. • DETROIT 7, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-47

The huge draw die shown here measures about 3 feet wide, 4 feet long, and 2½ feet deep. The plastic face of the die cavity and punch, approximately ⅜ inch thick, are made of Rezolin Toolplastik based on BAKELITE Epoxy Resins and compounded by **Rezolin, Inc.,** Los Angeles, Calif.

25% LESS COST—40% LESS TIME
TO FACE THIS DIE WITH EPOXY RESINS

"Rezolin" tooling compounds, based on BAKELITE Brand Epoxy Resins, are liquid materials. Thus a simple casting operation formed this die face to the desired shape. By mixing the resin with a liquid hardener before pouring, it was cured at room temperature without applied heat or pressure. Shrinkage was so slight that finishing operations were kept to a minimum.

When cured, the epoxy resin compound is hard and tough, with excellent impact, compression, and flexural strengths. The face of this die is only ⅜ in. thick, yet it stamps sheet steel into auto trunk lids. If design changes are needed, the surface can be readily machined or patched to fit new contours.

Jigs, spotting racks, checking fixtures, and Keller models are examples of other metalworking tools made with these compounds—usually by laminating with glass cloth. This construction results in excellent dimensional stability and accuracy. Tools are lighter and easier to handle than when made of conventional materials. They are strong and durable because of the hardness of BAKELITE Epoxy Resins when cured.

You'll benefit from the advantages of tooling with BAKELITE Epoxy Resins when speed is important . . . where model changes are frequent . . . when modifications in design are a factor . . . where a large variety of models demands a number of tools in a hurry. Take your first step toward efficient, up-to-date tooling with compounds based on BAKELITE Epoxy Resins.

BAKELITE BRAND EPOXY RESINS

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC

Deep-draw costs come down—fast . . .

. . . thanks to the Pennsalt FOS Process. Any way you look at it, severe deep-drawing of automobile parts, such as these bumpers, is being made easier, cleaner, and more economical by modern Pennsalt drawing lubricants. Steel strip comes to the dies pre-coated with Foscoat 40 and Drawcote. Foscoat is a phosphatizing compound that prepares the work for the appropriate dry FOS lubricant; Drawcote (product of Pennsalt's newly-acquired Gilron Division) forms a dry, homogeneous protective and lubricating film to speed the most severe drawing operation.

With these two Pennsalt chemicals, the auto industry is deep-drawing, stamping, and extruding steel parts at much lower cost than was previously possible. Die life is greatly increased. Plating is smoother with less finish buffing, because drawn parts are freed from die seizures, scratching, and irregularities. And these modern *dry* lubricants make the press shop a cleaner, safer place to work in.

For the severest deep draws in ferrous metals, the combination of Foscoat and Drawcote is literally working wonders. For lighter draws, and for certain special applications, Drawcote *alone* is recommended. With the full FOS line (Fosclean, Fosrinse,® Fospray, Foscoat,® Drawcote,® Foslube®), Pennsalt offers a process to meet every ferrous metal drawing requirement. And what is more, metal pre-coated with the FOS Process seldom needs re-coating for the next press stages.

For information on the Pennsalt FOS Process to fit *your* drawing or stamping needs, send blueprints of parts you're cold-forming, and give us details on type of steel, length of run. No obligation, of course. Customer Service Department, Pennsylvania Salt Manufacturing Company, 1103 Widener Building, Philadelphia 7, Pa.

FOSCLEAN AND FOSPRAY ARE TRADEMARKS OF PENNSYLVANIA SALT MFG. CO.

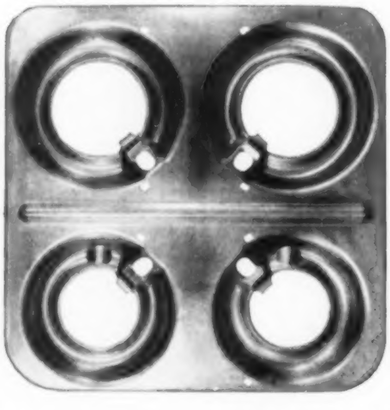
Chemical Progress Week May 16-21

Pennsalt Chemicals

Plastic Low Cost Tooling

For

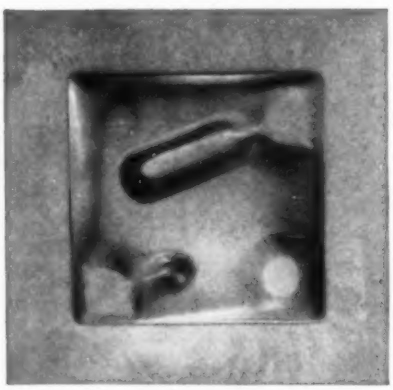
Dies . . . Drill, Welding, and Assembly Jigs



Vulcan, keeping pace with modern tooling, can recommend plastic tooling for medium production on numerous tool programs.

Plastic tools are light in weight, have good impact, compressive strength and dimensional stability. No hand finishing of parts required as galling or marking is eliminated by using plastic form dies.

Contours and odd shapes are cast or laminated to suit individual tools, saving expensive machine and hand finishing operations.



Plastic tools, built in a matter of days instead of weeks, lower your tool costs for those medium production runs.

Our actual production figures prove plastic has a definite place in modern production.

Vulcan Tool Company's organization, building fine tools since 1916, believes new tooling developments must be proved by tool engineers. Since plastic is not a cure-all your problem should be handled by recognized, practical tool men.

Our engineering staff will recommend the correct plastic material and advise if parts of your tooling program should be in plastic.

Send a part print and your production requirements for quotation and recommendations.

Major Vulcan Services . . . Engineering, Processing, Designing and Building . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. Vulcanaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

VULCAN TOOL CO. . . . PLASTIC TOOL DIVISION

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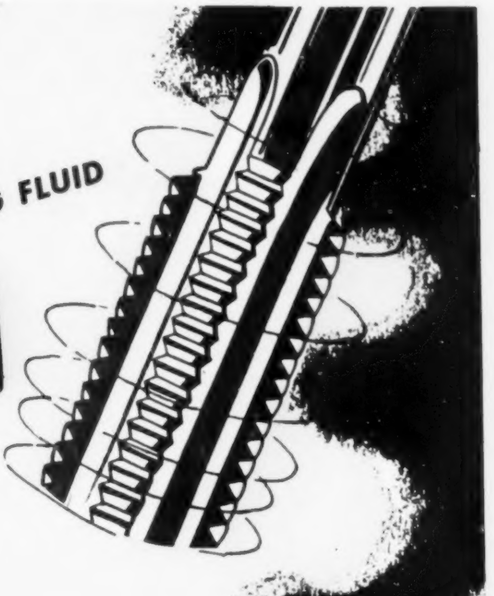
NOW!

THE NEW PRODUCTION PROVEN TAPPING FLUID

METALUB 333-A



FASTER!
SMOOTHER TAPPING
LONGER WEAR
FOR YOUR TOOLS!

TAPPING

Was never so easy and smooth.

DRILLING

Gives faster production and saves your tools.

REAMING

Makes reamers cut without chatter or breakage.

BORING

Just try 333-A— you will be glad you did.

Metalub No. 333-A produces a degree and kind of lubrication never before available for tapping metals. There is nothing like it for clean sharp threads and increased tap life. No. 333-A is also recommended for other metal working operations such as punching, drawing and broaching. It also gives good results when used with the new fluteless taps.

FREE SAMPLE and technical data sheet describing the use and application of this product is available upon request.

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50 THROUGH 300-TON CAPACITIES

NIAGARA MACHINE & TOOL WORKS 75 1879 1954

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

GREENLEE

special-purpose machines for profitable mass production

THEY SAVE WORK...THEY SAVE MONEY

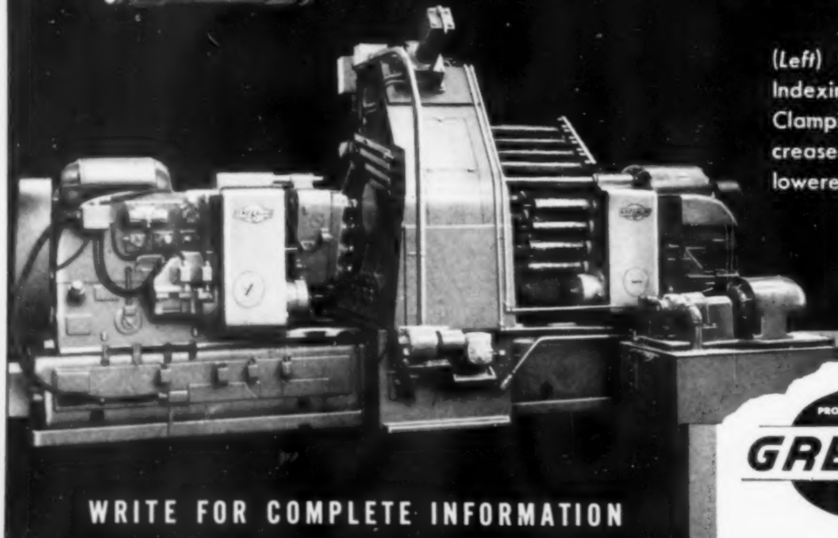
Master brake cylinder machined on above Greenlee Special Machine.

If you are being outdistanced in today's swift race for production...faced with narrowing profit margins...it will pay to investigate Greenlee Special Machines. Savings effected on drilling, reaming, boring, counterboring and tapping operations will quickly amortize your invested dollars.

Wheel cylinder machined on Greenlee Special Machine shown below.

(*Above*) Greenlee Horizontal Indexing Machine designed for processing master brake cylinders has proved itself with raised quality and lowered costs.

(*Left*) Greenlee Two-Way Horizontal Indexing Machine equipped with Power Clamping and Automatic Unloading increased previous production rates and lowered costs.



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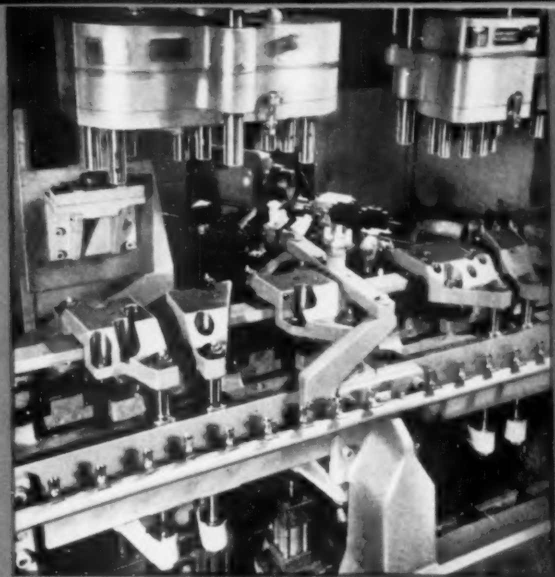
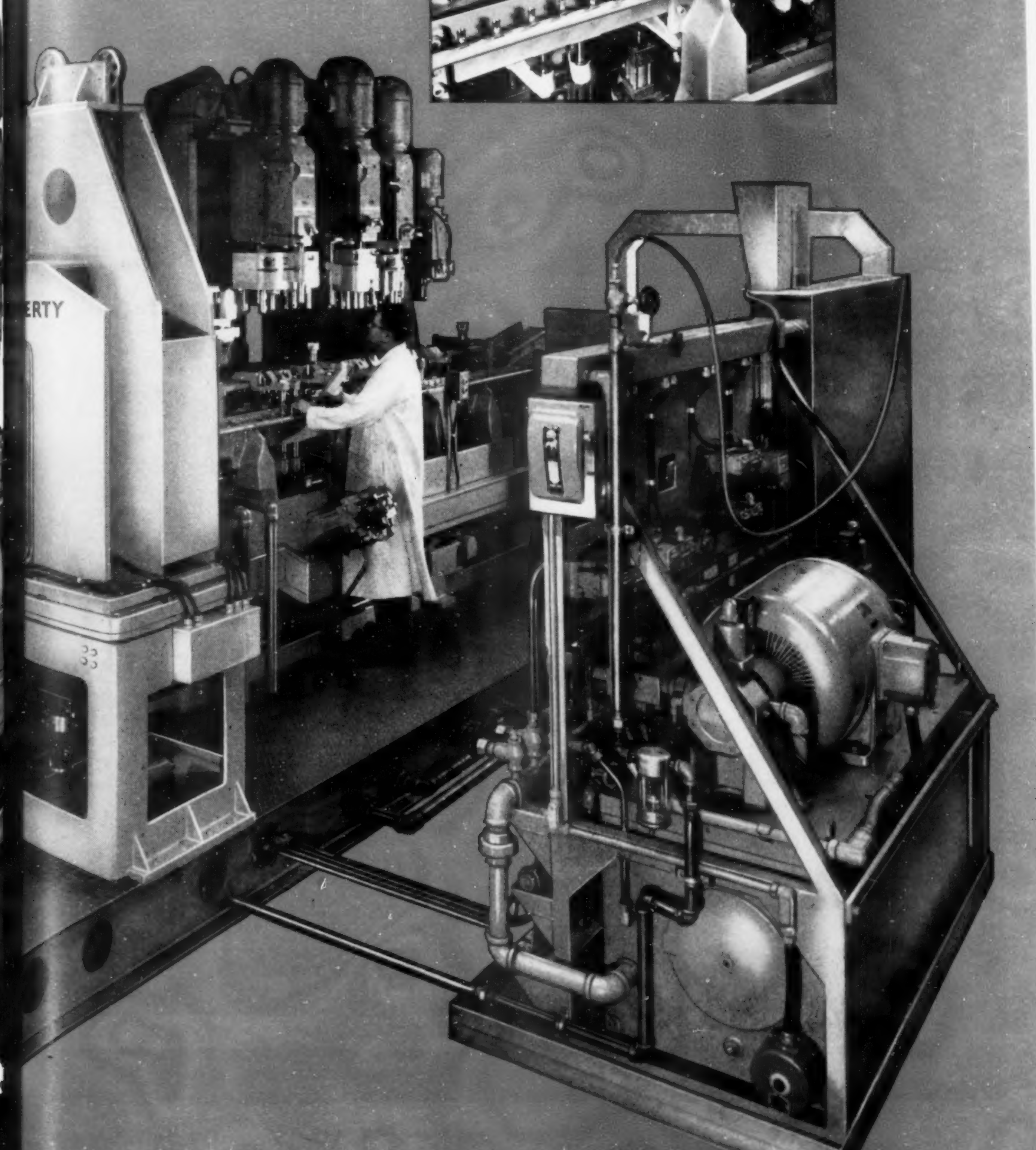
PRODUCTION MACHINERY
GREENLEE

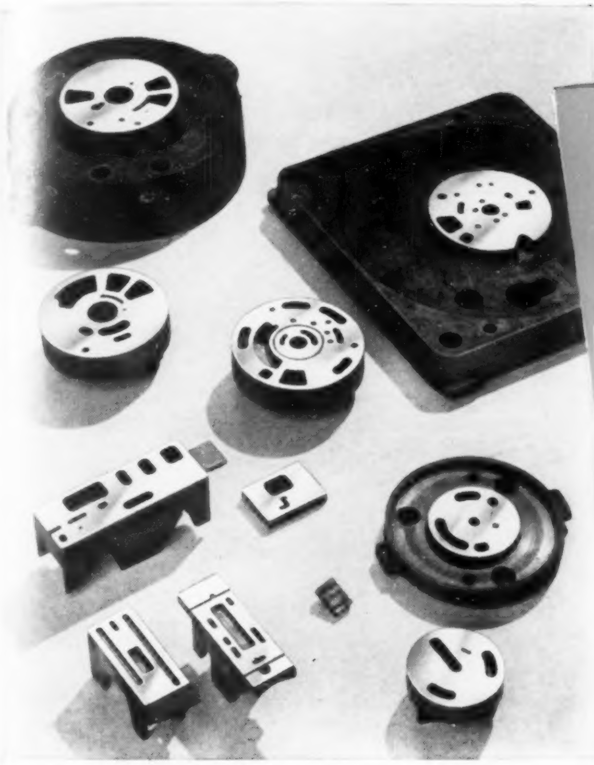
GREENLEE BROS. & CO.
1985 MASON AVENUE
ROCKFORD, ILLINOIS

by Liberty!



A close-up of two of the machining stations. Head on right is a 13-spindle tapping operation. Head on left is an 8-spindle burring, drilling, and reaming operation.





Get Precision Flatness, Finish and Parallelity on Valve Parts Like These . . . In Production Quantities With a *Lapmaster*®

Air brake valve parts like these are being production lapped on JOHN CRANE Lapmasters every day at a tremendous savings in time and money. For instance, one of the rotary valve seats shown here formerly required over two hours of lapping time to pass the "no leak" bubble test — time has now been cut to ten minutes on the Lapmaster.

This is the machine for you if you are looking for precision flatness and finish in quantity on all forms of ferrous and non-ferrous metal, ceramics, plastics or crystals. Lapmasters readily lap to the extremely close tolerance of one light band (.000011") or less. They also produce a fine finish to as low as 1 RMS.

You are invited to send us a few sample parts including surface finish specifications and approximate production requirements. Our lapping laboratory will then be in a position to provide you with complete facts on the application of the Lapmaster to your work. There is no obligation.

Crane Packing Co., 1823 Belle Plaines Avenue, Chicago 13, Ill.
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FREE TECHNICAL DATA

on the Lapmaster is available on request, also information on measuring flatness. Write for your copies today.

Lapmaster® DIVISION

CRANE PACKING COMPANY

38 YEARS INDUSTRIAL PROGRESS

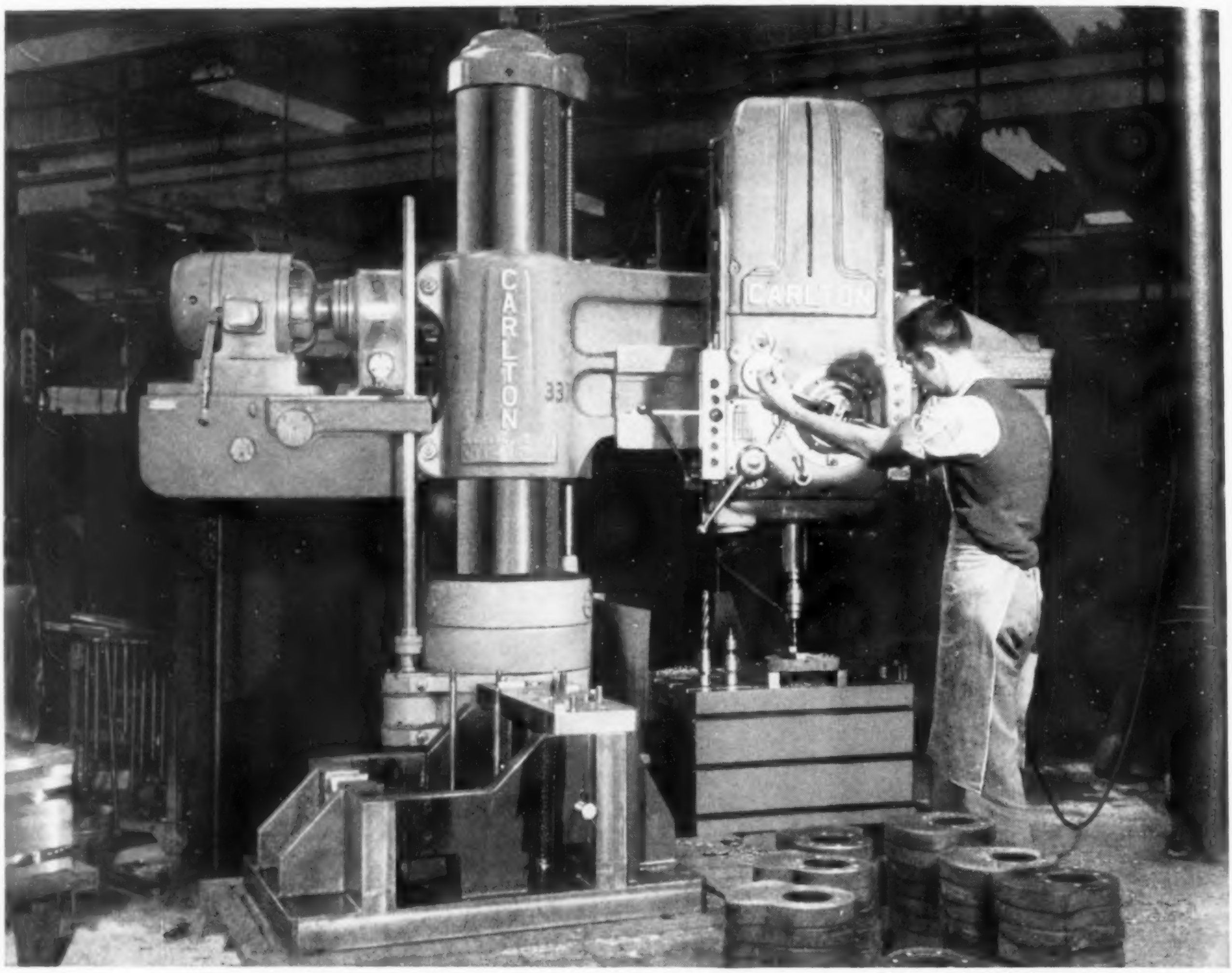
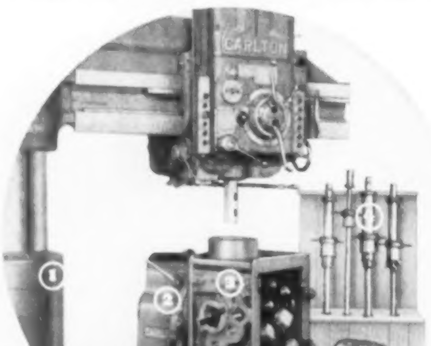


photo courtesy the Besser Co., Alpena, Mich.

Carlton production drilling for production line assembly



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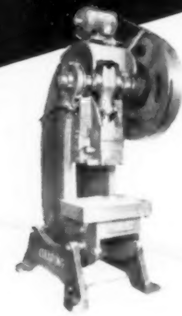
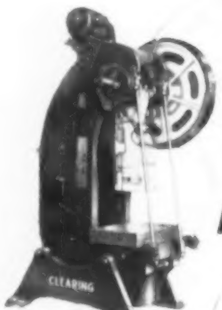
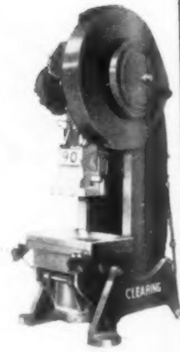


60 ton



75 ton



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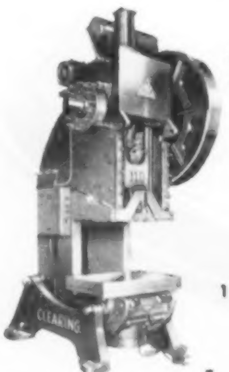
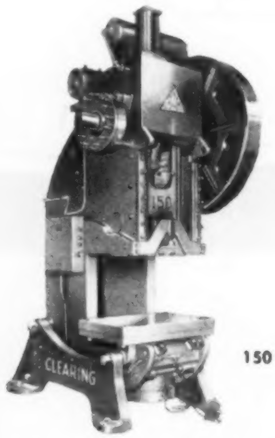
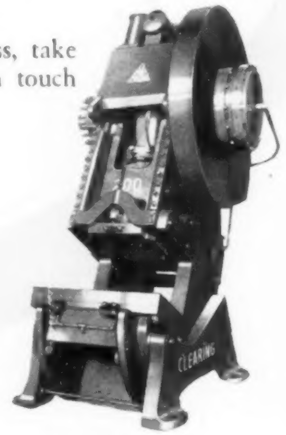


110 ton



150 ton



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The Tool Engineer

A Salute and a Challenge

Upon being installed as the leader of any organization, one reflects more than casually on the accepted obligation and responsibility of the office. As your new president, I sincerely hope that I shall fulfill these to the complete satisfaction of our membership.

In this, my first direct communication to the more than 31,000 members of ASTE, I salute each of you. Your contributions in tool engineering are making this great country of ours a better place in which to live. Your developments and introduction of new manufacturing processes and techniques are largely responsible for our high standard of living—the best in all the world.

Unfortunately, there are forces at work which may negate much that you have done and may make your future efforts less fruitful. I am referring to the continual interference with the basic fundamentals of economics, involving proposals such as guaranteed wages regardless of production.

I offer no scientific formula to refute the practicability of such ideologies but believe in certain fundamental principles which seem to be so obvious that one ponders the intent behind these proposals. You can't guarantee wages without guaranteeing production. You can't legislate production since it is dependent upon sales. Sales depend upon value. To produce this value, we must continue to teach American industry how to produce more goods for more people at lower cost—the past, present and future responsibility of the tool engineer.

H. B. Osborn Jr.

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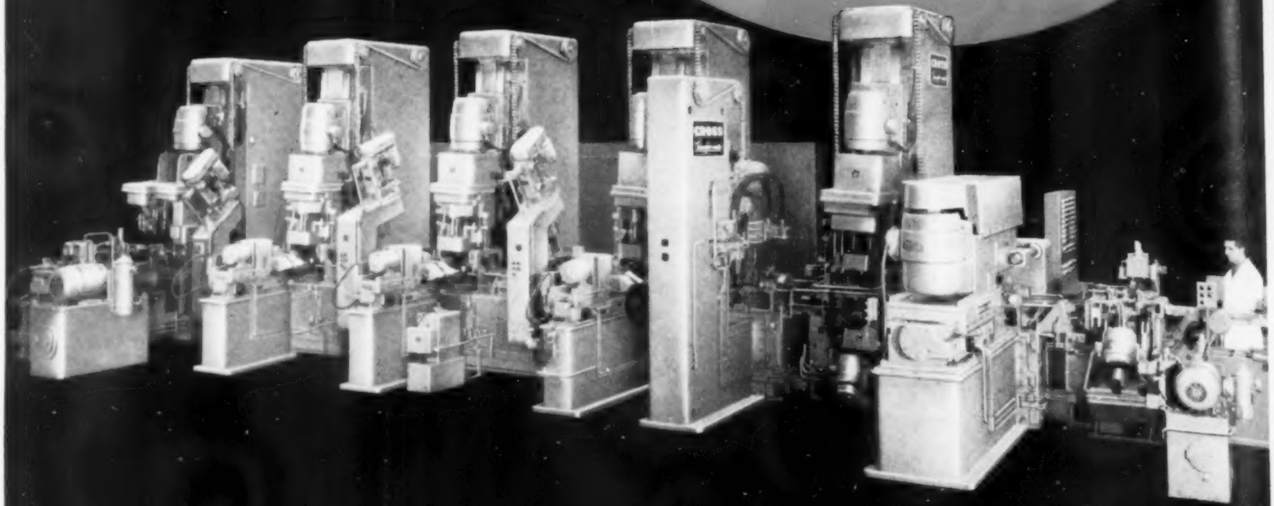

- ★ Rough and finish mills carburetor pad; mills choke pad (4 barrel only); bores carburetor port holes; drills and chamfers all holes (except 3 holes in water outlet pad); and taps all holes.
- ★ 140 pieces per hour at 100% efficiency.
- ★ Initial part location from port openings.
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- ★ 13 stations; 1 loading, 11 working, 1 unloading.
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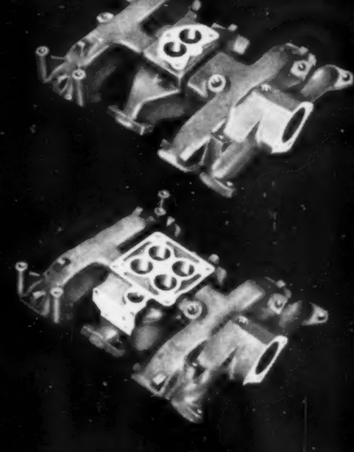

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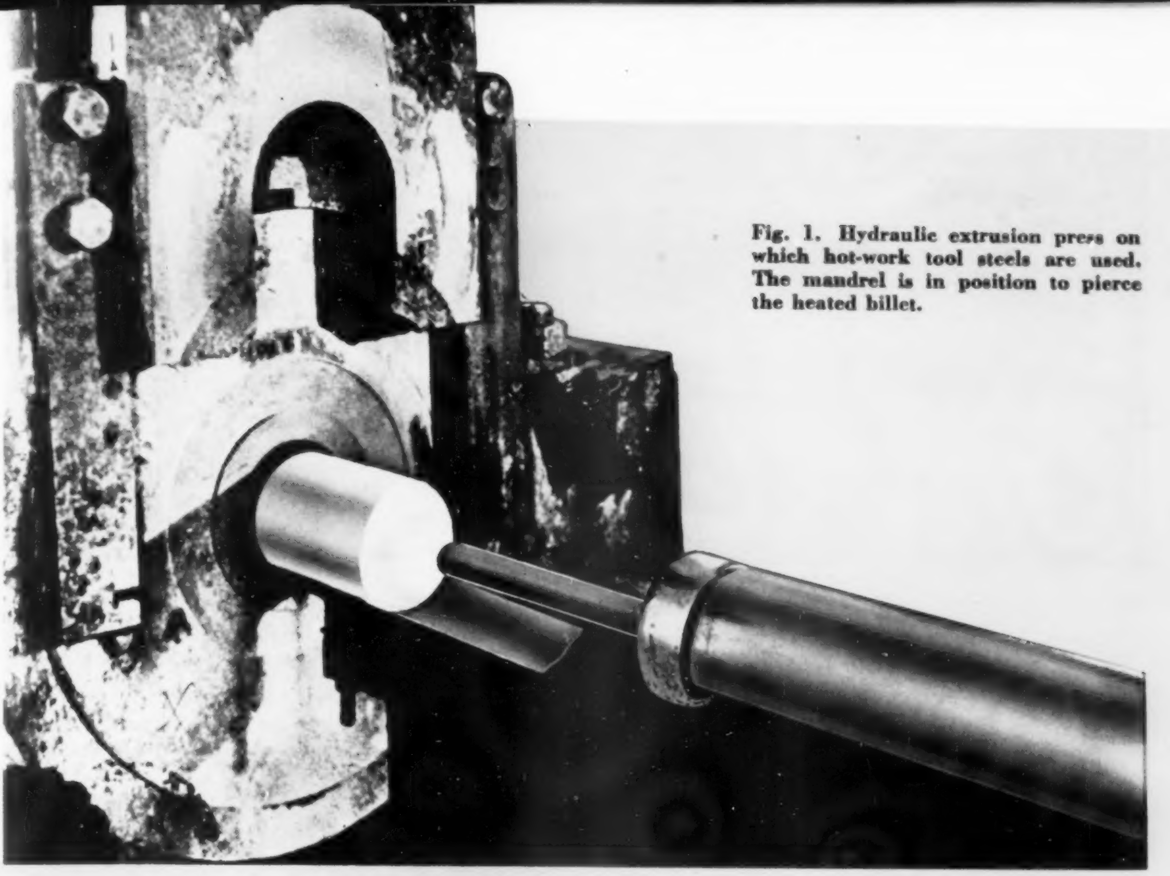


Fig. 1. Hydraulic extrusion press on which hot-work tool steels are used. The mandrel is in position to pierce the heated billet.

tool steels and their application

By R. F. Spillett

Tool Steel Service Engineer
Tool Steel Research Div.
Sanderson-Halcomb Works
Crucible Steel Company of America
Syracuse, N. Y.

To PROPERLY APPLY the many available types of tool steels to best advantage requires an understanding of their general characteristics. The special ferrous alloys that comprise the family of tool steels can be classified in basic groups according to their compositions, methods of hardening or conditions of use. The five basic groups are: carbon steels (water hardening), oil-hardening steels, air-hardening steels (high-carbon high-chrome), hot-work steels, *Fig.* 1, and high-speed steels.

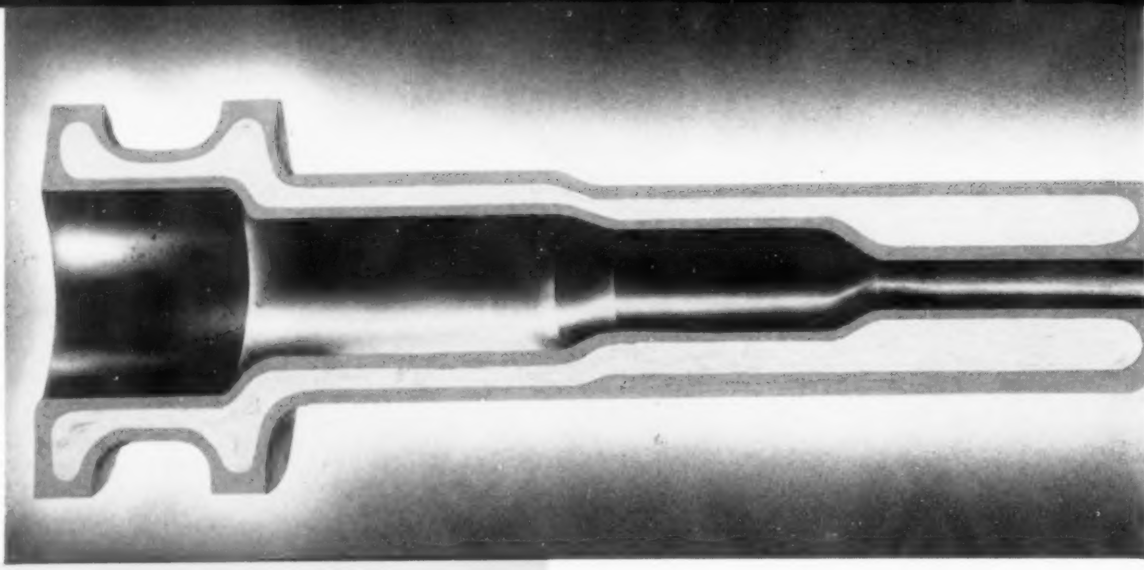
This article is based on a talk recently presented before the ASTE Atlanta and Little Rock chapters.

Considering what tool steels are doing today, it is difficult to realize that just 50 years ago the only one produced in quantity was carbon steel.

Carbon Tool Steels

These tool steels are best known and most used because of their characteristic of differential hardening, having a hard wear-resistant surface and a softer shock resisting core. This combination of properties is invaluable on applications such as pneumatic tools, cold header dies and cold striking dies. Due to the tremendous stresses set up during water quenching, these steels are not adaptable to tools with sharp corners, abrupt section changes or extreme differences in mass. Such tools may crack during heat treatment.

Depth of hardening can be controlled by the proper use of flushes and sprays, *Fig.* 2, and the correct choice of tool steel. Carbon steels are usually classified as: shallow hardening, medium



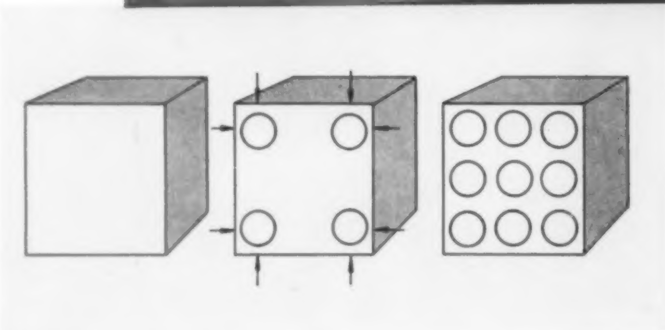


Fig. 2. (above) Cross section of a properly hardened rock drill piston illustrates the control of hardening that can be achieved.

Fig. 3. (left) Few holes can cause difficulties during water quenching but many equally-spaced holes result in a part of uniform sections.

hardening and deep hardening. Shallow hardening steels are usually used for thin and small sections while the deep hardening steels are used on heavy sections. Steels with high carbon contents are usually shallower hardening than the lower carbon content steels. Also, the higher carbon steels have greater wear resistance but are not as tough. Size of cross section has an effect on the depth of hardening. Smaller sections harden to a greater depth.

A simple, solid geometric shape, *Fig.* 3, represents a part that is suitable for water quenching. Introduction of a few holes, as shown, can make a part that is difficult to harden because thin sections are adjacent to thick. By adding more equally-spaced holes, quenching hazards are reduced.

Typical sections that should not be made of water-hardening steels are shown in *Fig.* 4. Large differences in section thickness lead to breaking, *Fig.* 5, during the quench. Although carbon tool steels have good machining properties, they are liable to change size considerably during heat treatment.

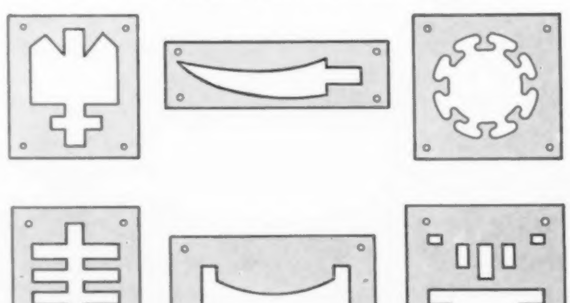
Oil-Hardening Tool Steels

Steels become oil hardening after the addition of significant amounts of alloying elements such as manganese, chromium, tungsten, vanadium or molybdenum. These alloying elements allow the steel to fully harden by immersion in oil, even in large sections. Since the cooling rate is slow, oil-hardening steel can be used for tools with sharp corners and abrupt section changes, *Fig.* 6. However, since they are full hardening, these steels do not have shock resisting cores.

Oil-hardening tool steels do not change size greatly during heat treatment and this can be an extremely important factor in tool design. Also, tools made from oil-hardening steels can be reground more often than those of carbon steels where repeated grinding removes the hardened case. However, alloying elements in oil-hardening steels reduce machinability 15 to 20 percent compared to straight carbon steels.

Regardless of analysis or type, tool steels undergo similar transitions during hardening. As an example, there follows the description of what happens when a piece of oil-hardening tool steel is heated and cooled. Analysis of the steel is: carbon,

Fig. 4. Square corners and sharp angles should be avoided when designing dies of carbon tool steel.



0.90; manganese, 1.25; chromium, 0.50; tungsten, 0.50; and iron, the balance.

In the annealed condition, hardness of this steel is about 190, Brinell. The carbon and alloying elements are combined chemically with part of the iron so there is a mixture of free iron or ferrite and carbides. The steel is soft, ductile and magnetic, and has practically no carbon dissolved in it. It could be repeatedly heated to and quenched from temperatures under its critical temperature of 1370 F without changing either the hardness or structure.

When temperature exceeds 1370 F, carbon can go into solution with the iron or iron compound. This solid solution of carbon and iron, called austenite, is nonmagnetic. Further heating dissolves more carbon but, if the temperature goes too high, coarse grains will result.

In normal hardening, a compromise is made by heating to a temperature that will result in good carbide solution without grain coarsening. For the steel being considered, heating would be stopped at 1450 F. The secret of hardening is to trap the austenite by a fast quench. If the quench is fast enough, the carbon will not have time to precipitate out of the iron as it does during annealing, and the steel will be hard at room temperature and again magnetic.

There are two important temperature ranges during the cooling of tool steels. One of these is from about 1350 to 900 F; the other is from approximately 700 F to room temperature. If the time taken in cooling from 1350 to 900 F is long, the steel generally will be soft when it has cooled to room temperature. Carbon steels must be cooled through this temperature range as quickly as possible in order to be hardened. Oil-hardening steels will be hard even after a longer cooling period.

Cooling time can be regulated by the choice of quenching medium—air, liquid salt, oil or water. The time during which transformation from austenite will occur varies with the composition of the steel. High-alloy steels require longer for transformation. If transformation does not take place in the range from 1350 to 900 F, generally, the steel will harden while it cools to room temperature. If transformation does take place, the steel will be either soft or only partially hardened after cooling.

Austenite transformation of any steel may take place over the entire temperature range from critical to room, but at some temperatures, the tendency to transform is much greater than at others. These tendencies are shown on charts called transformation-temperature-time (TTT) curves.

A typical TTT curve, *Fig. 7*, shows what happens during cooling, the most critical period of heat treatment. The time scale is in seconds, minutes and hours. The left-hand curve represents the beginning of transformation at any temperature and the right-hand curve shows where transformation ends. If the piece of oil-hardening steel is heated to the hardening or austenizing temperature of 1450 F, plunged into a salt bath at 1300 F and held at that temperature just under eight minutes, it will remain austenite as it was at 1450 F. If it is held at 1300 F longer than eight minutes, transformation starts and the austenite begins to decompose to ferrite and carbide. If the piece is held at 1300 F for three hours, all the austenite will be decomposed. Specific TTT curves are made by plotting the beginning and end of transformation at several temperature levels. Rockwell hardness values are also obtained and indicated on the curves.

In quenching an oil-hardening steel of this type, only that part of the steel that is cooled below 1100 F in about 10 sec will harden. If the quenching-oil volume is sufficient, it is possible to reduce the temperature of large sections of this steel below 1100 F in the required time. As the steel is cooled further, longer delays are possible before transformation begins. At 500 F, transformation will not begin before about ten minutes. The steel that transforms to ferrite and carbide during this phase of cooling does not later transform to martensite.

If the test piece is cooled to 500 F without transforming, it will have the same austenite structure

Fig. 5. A thin flange combined with a heavy hub cannot be made with ordinary carbon tool steel. Stresses set up during quenching resulted in complete separation of the sections.

Fig. 6. Shattered carbon steel die represents improper selection of tool steel. The thin and thick sections could safely have been heat treated if the die had been made of oil-hardening steel.

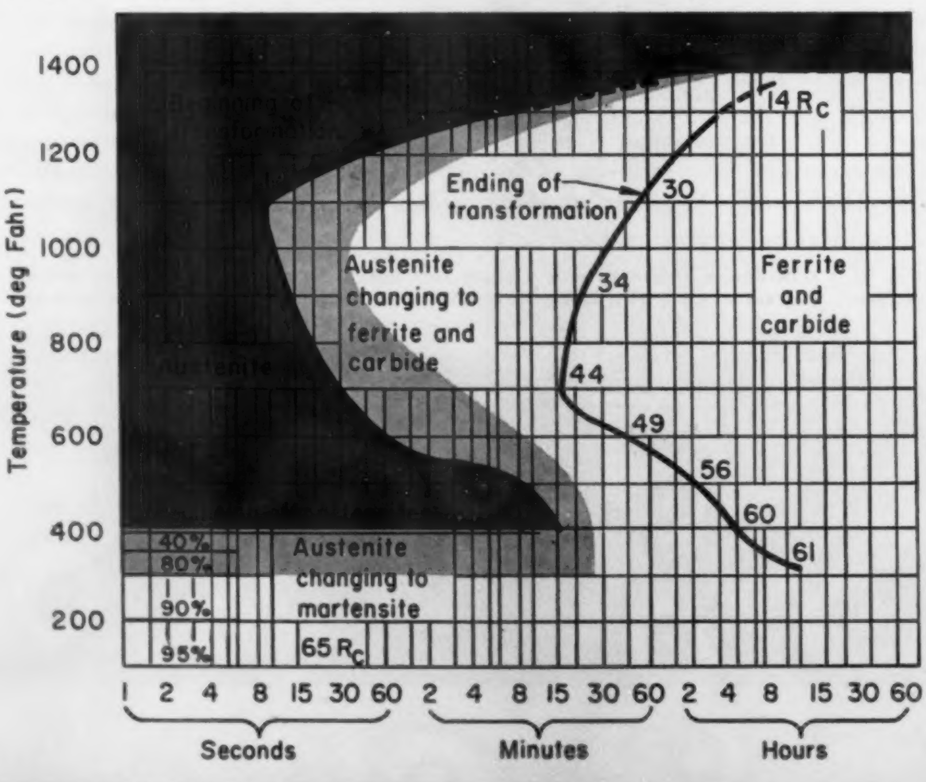
it had at 1450 F. As cooling continues, the structure begins to change at about 390 F. The austenite begins to transform to martensite and this transformation continues as the temperature falls. At room temperature (70 F), the structure is 99 percent martensite. Hardness of the steel depends on the amount of martensite formed.

However, as austenite transforms, the piece expands because martensite is not as dense as austenite. Expansion in a material that is becoming harder can cause the piece to break. The as-quenched martensite must be tempered to relieve the stresses. If the part is left at room temperature for any appreciable time, the stresses will probably burst the piece. If it is transferred from the quenching medium to the tempering furnace too soon, only that martensite which has formed will be tempered. Cooling after tempering will cause the retained austenite to transform to untempered martensite with expansion and danger of cracking. If tempering is done too soon, or too late, breakage may result.

The best time to temper any tool is at that temperature at which it can be comfortably held in the bare hand, about 100 F. Tool breakage and change in size during hardening are usually caused by missing this vital point.

Almost all metals expand on heating and contract on cooling, although at different rates. A simple carbon tool steel expands on heating to the critical temperature, 1350 F, at which point it contracts. During this contraction, austenite is formed and carbon is dissolved. As the temperature increases, expansion again takes place up to the har-

Fig. 7. Transformation-temperature-time curve for a typical oil-hardening steel. That portion of a piece that is reduced in temperature below the value at the nose of the left-hand curve in 10 sec can be hardened.



ening temperature. During slow cooling, as in annealing, the process is reversed. If the steel is to be hardened by quenching in water, the contraction takes place rapidly, in which case expansion through the critical range is bypassed. But, as the steel begins to harden at slightly below 400 F, it expands. Expansion continues to room temperature. Expansion and contraction on heating and cooling reflect internal changes that take place.

Unequal sections, sharp corners, abrupt changes in section, nonhomogeneous material, *Fig.* 8, and even tool marks act as stress raisers. The effect of mass on temperature difference from outside to center of a piece complicates the hardening process and introduces stresses. It is these internal stresses that cause tools to break. Tempering relieves some of these stresses and it is important that tools be tempered immediately to prevent breakage.

Air-Hardening Tool Steels

These steels are characterized by high-carbon and high-chromium contents with varying amounts of vanadium and molybdenum. Because of the slower quench, they do not deform during heat treatment and can be used where die and tool design is intricate. These steels have better wear resisting properties than the oil-hardening group and usually are selected where long production runs are anticipated. They are used for such applications as lamination dies, forming dies, gages, drawing dies and thread-rolling dies. Most of these steels are hardened from higher temperatures (1750/1850 F) and at longer soaking times than oil-hardening steels, and for this reason should be carefully protected by using a controlled-atmosphere furnace or by packing in some inert material. In general, air-hardening steels are interchangeable with oil-hardening steels, and give longer life and increased performance.

In order to gain some desirable property in a tool steel, however, it is often necessary to give up or reduce some other desirable property. When hardness is increased, toughness is decreased. When maximum wear and abrasion resistance is required, machining is difficult. Most hard high-carbon high-chrome steels have low impact values. Grinding of air-hardening steel must be done with care because its abrasion resistance causes the grinding wheel to generate more heat. This causes greater expansion in the tool, which can result in grinding cracks. Localized overheating of the cutting edge lowers its hardness and results in poor life.

Since these steels are wear resistant even in the annealed condition, they are difficult to machine. In applications where a high-carbon high-chrome steel should be used, the 1.50-carbon type (C, 1.50; Cr, 12.00; Mo, 0.80; and V, 0.20) is usually the best choice for the widest general uses. It machines and grinds a little easier than higher carbon types and is tougher. The high-carbon type (C, 2.25; Cr, 12.00; Mo, 0.80; and V, 0.20) should be used where extreme abrasion resistance is imperative.

If the carbon steels are considered to have a machinability rating of 100, oil-hardening steels would be about 81, the 1.00-carbon type (C, 1.00; Cr, 5.00; Mo, 1.00; and V, 0.40) air-hardening steel would be 75, the 1.50-carbon type would be 66

Fig. 8. Mill decarburization was removed from only two sides of this oil-hardening steel. Transformation characteristics of the decarburized material were different from those of the base metal, which led to breakage.

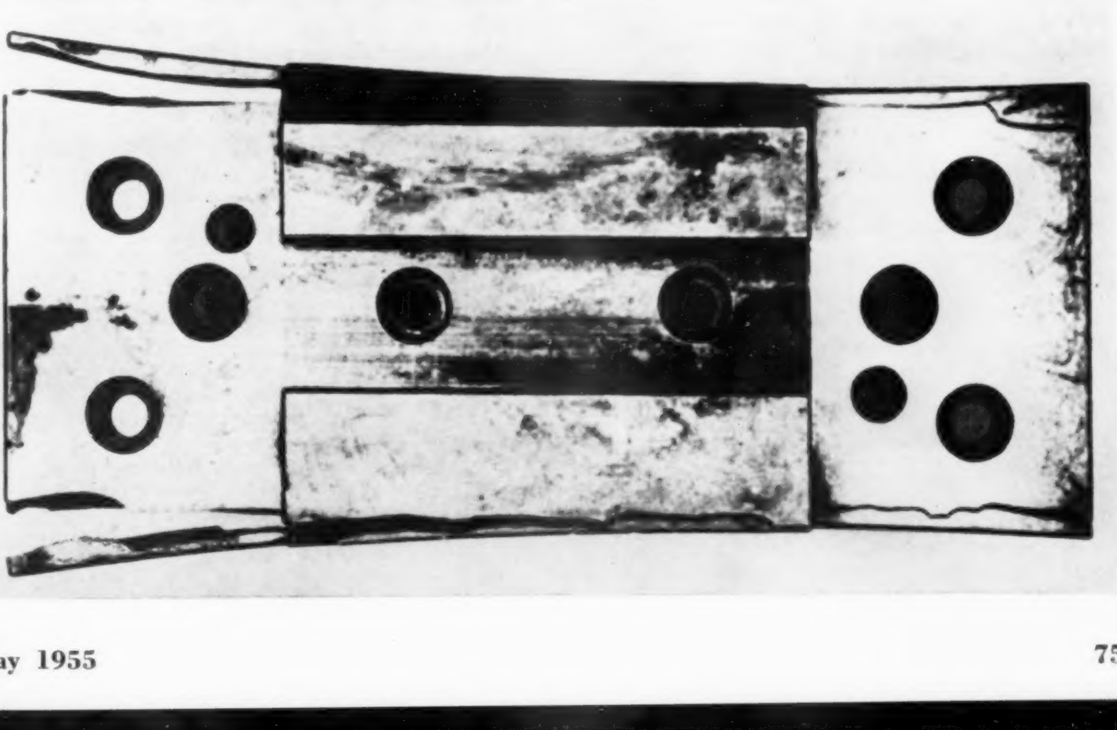


Table 1—Typical Hot-Work Steel Analyses

C	Si	Cr	W	Mo	V
0.40	1.00	5.00	—	1.35	1.10
0.40	1.15	5.25	4.25	—	—
0.28	—	3.25	9.00	—	0.25
0.40	—	2.00	11.50	—	0.35
0.30	0.50	12.00	12.00	—	0.90

and the 2.25-carbon type would be considerably less.

The 1.00-carbon air-hardening steel should not be overlooked since it is twice as tough, gives up to three times the life, has better dimensional stability than oil-hardening steel and is not too difficult to machine.

Hot-Work Tool Steels

As its name implies, this group of steels is applied in hot-working operations. Such steels are resistant to softening, heat checking and cracking, and have good wear resistance when used at elevated temperatures. Hot-work steels are used as forging or forming tools for workpieces in the temperature range of 1100-2000 F. Straight-carbon or chrome-nickel steels are often used on drop hammers, where contact with the hot workpiece is not prolonged, and are satisfactory on such jobs, but extrusion presses, *Fig.* 1, and forging machines require highly alloyed tool steels for satisfactory service. This group of steels maintains high hardness even after heating to 1100 F. Demands for greater accuracy, closer forged sizes and more intricate shapes are causing development of hot-work steels with different combinations of hardness, toughness and wear resistance.

Hot-work steels vary in composition from steels with a low alloy content to those more highly alloyed than high-speed steels, Table 1. These steels are used in such applications as hot heading, gripper and extrusion dies, hot shear blades and punches.

It is sometimes possible to flood tools with a continuous flow of water to keep the heat down, or the tools may be used in sets and periodically changed. However, intermittent heating and forced cooling of these steels usually results in early failure from thermal cracks. Proper preheat of tools before use, alignment and lubrication also affect service life.

High-Speed Tool Steels

These steels have been named to reflect their ability to maintain a sharp cutting edge when used at high speeds with heavy cuts and feeds. Their main application is for cutting tools but they are also used in punches and dies.

Tools with a single cutting edge are usually used in straight sections and include: lathe tools, planer tools, roll-turning tools, cutoff tools and special form tools. Tools of this type usually require good resistance to shock and vibration, and frequently need carefully balanced combinations of red hardness, abrasive resistance and toughness.

Twist drills and double-edge chamfering cutters are the principal double cutting edge tools. They usually require extreme toughness in torsion as well as resistance to vibration and wear. There is probably as much high-speed tool steel used in multiple-tooth tools as is used in the other groups combined. Typical tools are: gear cutters, end mills, milling cutters, taps, hack saws, broaching tools and form tools, *Fig.* 9. Uniformity of the steel is the most important quality required of steels for such tools.

Punches and dies do not necessarily require sharp cutting edges but do need toughness, red hardness and wear resistance. Because of the toughness required, steels for such applications usually have less carbon than those for cutting tool application. Some of the commonly used types of high-speed steel are listed in Table 2 in the order of their outstanding properties. The alloying element, vanadium, governs resistance in the abrasion-resistant group. These materials are used for good finishes and light scale cuts on highly abrasive materials.

Cobalt governs the main property of the red hardness group. Red-hard steels are used for severe cutting operations with heavy feeds and cuts, and

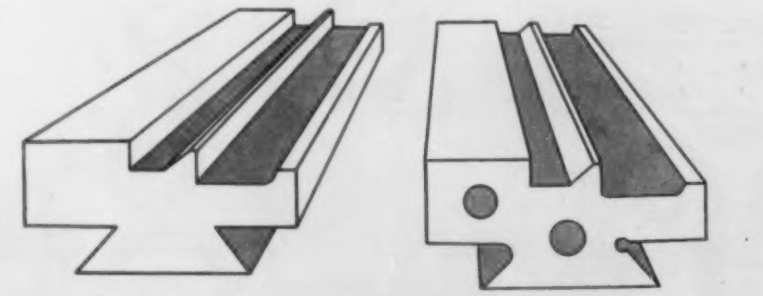


Fig. 9. As initially designed, left, this high-speed steel form cutter would be difficult to heat treat. Two types of radii are shown at right, either of which would improve the design. The two added holes make section thickness more uniform.

gh speeds. Molybdenum increases toughness while dditions of cobalt and tungsten lessen toughness. ost twist drills are made from molybdenum steels ecause of their outstanding toughness.

ool Steel Failure

Without regard for order, the five main reasons or tool steel failures are: defects in the steel, poor ool design, mishandling of the finished tool, improper heat treatment and selection of the wrong type or grade of tool steel. Chemical analysis of tool steels should conform to established standards, since variations in chemical analysis may result in unsuccessful heat treatment. Such factors as hardness, depth of case, breakage, size change and warpage are directly dependent on chemical analysis.

Table 2—High-Speed Steel Analyses

(listed in descending order* of outstanding property)

W	Cr	V	Co	Mo
Abrasion Resistance				
18	4	4	—	—
14	4	3	—	—
18	4	2	—	—
6	4	2	—	5
18	4	1	—	—
Red Hardness				
19	4	2	12	—
18	4	2	8	—
14	4	2	5	—
6	4	2	5	5
18	4	1	5	—
18	4	2	—	—
18	4	1	—	—
6	4	2	—	5
Toughness				
—	4	2	—	8
1½	4	1	—	9
6	4	2	—	5
14	4	2	—	—
18	4	1	—	—
18	4	2	—	—
18	4	2	8	—
19	4	2	12	—

*Based on single-point cutting tool tests.

Seams, laps, strain cracks and other surface defects are detrimental because they lead to cracks during heating and quenching. Internal defects such as pipe, bursts, flake and weak centers are difficult to detect and may result in cracking of the tool steel during forging or heat treatment. Severe carbide and alloy segregation at the center of a bar can also cause crackage during heat treatment. Low hardness can result from segregation.

Excessive or spotty decarburization caused by poor billet preparation is a defect because the transformation characteristics of the decarburized area differ from that of the base metal, *Fig.* 8. Tool steels should be in a properly annealed condition before they are used to make tools. This is necessary not only so they can be machined but to achieve the desired response from heat treatment. Hardenability, size change and cracking faults can be the result of poor annealing.

Tools that require heat treatment after machining should have generous fillets at changes in section, and sharp angles should be avoided if possible. Equalization of mass by introducing holes in heavy sections, *Fig.* 9, will provide uniformity of temperature during heating and cooling, and prevent breakage and distortion. Growth, shrinkage and distortion are functions of the design as well as the steel analysis and heat treatment.

Misapplication is probably one of the largest causes of tool-steel failures. With modern production controls and tests, uniformity of tool steels is such that lot-after-lot will respond in the same way to the same heat treatment and repeatedly give comparable service results. If the wrong tool steel is used for an application, the quality and care that has gone into the tool and steel is wasted. A tool is worth no more than its scrap value until it is heat treated, regardless of the time, money and effort that has been put into it.

Beading Titanium Without Cracks

Cold-forming titanium sheets to make curved cylindrical shell beads is possible without cracking through a development achieved by Chance Vought Aircraft, Inc. Birth of the process came with need for a stiffer, lighter shroud wrapper around the extremely hot afterburner section of a jet engine.

In the new method, metal to be beaded is fed between small adjustable-tension forming rolls on an adapted standard Niagara machine. Flow of metal is controlled by vise-like adjustable hoops that confine the metal on all sides of the roller wheels. The bead is rolled so the grain of the metal is normal to the longitudinal circular axis of the bead. When they are across the grain in this way, beads of various shapes and depths may be produced without danger of cracking.

Both external and internal beads were made on 0.012-inch stainless steel and 0.012-inch RC-70 titanium. In stainless, beads were produced to a width of 0.25 inch, and were raised 0.77 inch or depressed 0.57 inch. Springback of the sides was about 4 deg. Because of titanium's lower percentage of elongation, its formability is less.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Spacer Bushing for Uniform Centers

When centering parts that require an accurate linear relationship between the center and the end, a spacer bushing such as illustrated can be used to advantage. In fact, the idea should be worth consideration of tool engineers in making up tolerance charts for control of stock removal and accumulated tolerances. With this method of centering, the tolerance between the end face and the center hole is held to a few ten-thousandths inch.

Often it is necessary to maintain such uniformity on production lots of parts that require later operations such as grinding to a shoulder or to control uniform stock removal in facing or recessing. Size of the center hole in the work is determined by adjusting the depth of the combination center drill through the spacer bushing in the drill chuck. The spacer bushing may be locked to the body diameter of the drill, if desired, with a small setscrew to prevent its loss. The jaws of the chuck back up the bushing at the full depth of cut.

W. R. Eldridge
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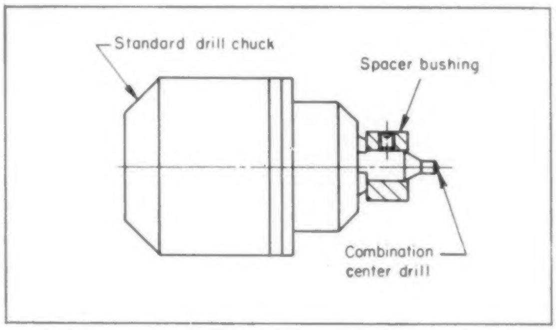

Setup for Turning V-Groove

On low-volume contract parts the tool engineer's ingenuity in working out economical production methods with available equipment often spells the difference between profit and loss. For instance, in the case illustrated an efficient production setup was devised that involves a minimum of operator skill and effort. The part is a thin-walled shell for an optical instrument. One of the requirements is to finish turn each flank of a deep V-groove. However, the shell is too light for the use of a form tool.

In order to complete both sides of the "V" in one setup a boring head is mounted in the tool post. Also small hand knobs are mounted on the feed screw and on the locking screw. In production the compound is set at a 60-deg angle to the centerline of work, using the graduations on the base of the lathe. Next the boring head is set at a 45-deg angle to the centerline of work with a gage or protractor against the faceplate or chuck, or against a mandrel set up in the lathe.

Once the job is set up, the part is quickly machined by feeding the tool in on the compound centerline to complete the 60-deg surface. The second surface is then machined by feeding the tool out as shown. This arrangement afforded a ready means of performing an operation which would have been time-consuming and troublesome by a conventional method such as swinging the compound.

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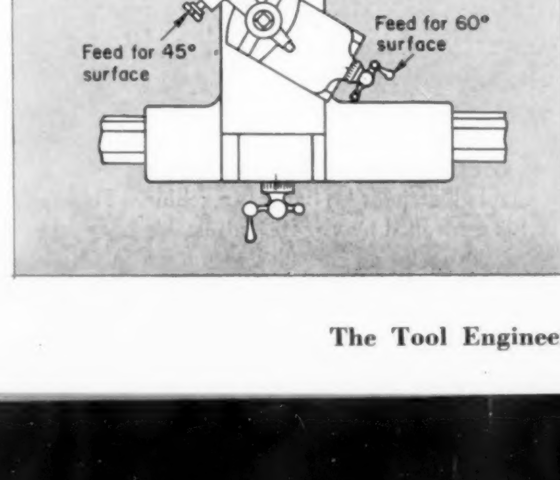
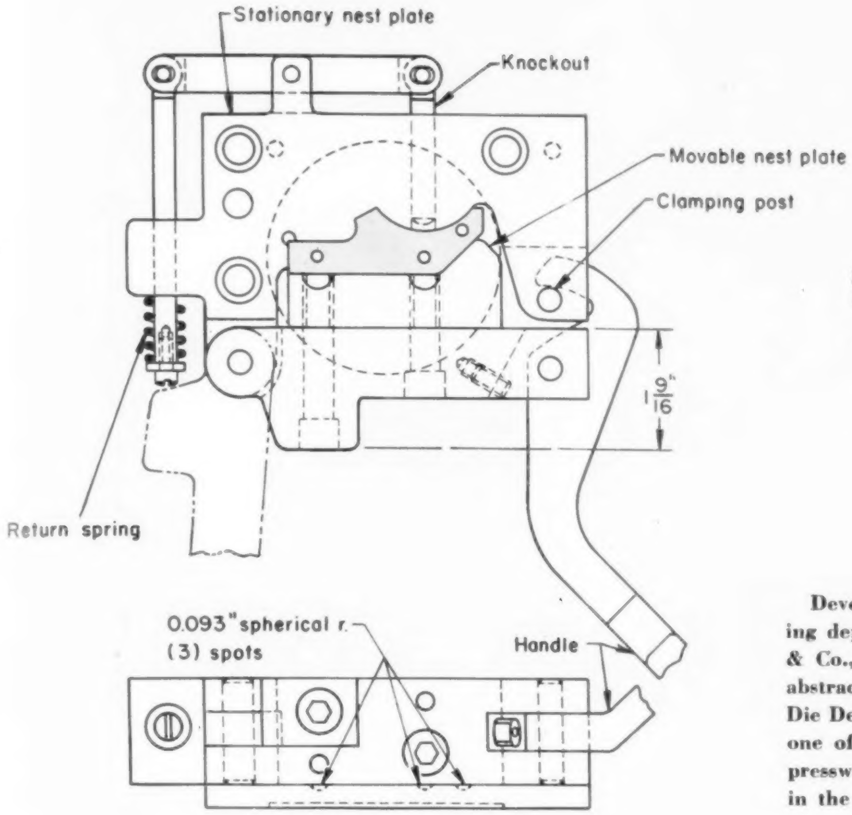
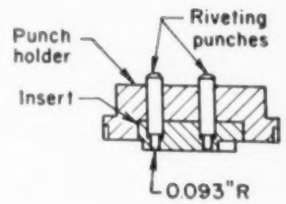






Developed by the tool engineering department of Fairbanks-Morse & Co., the following die design is abstracted from the forthcoming Die Design Handbook. It represents one of many practical solutions to pressworking problems to be found in the book.

Assembly Die

Accurate positioning and holding a pile or stack of thin metal sheets in exact alignment is the primary problem in the design of a die to assemble laminated rotor and stator cores for motors and generators.

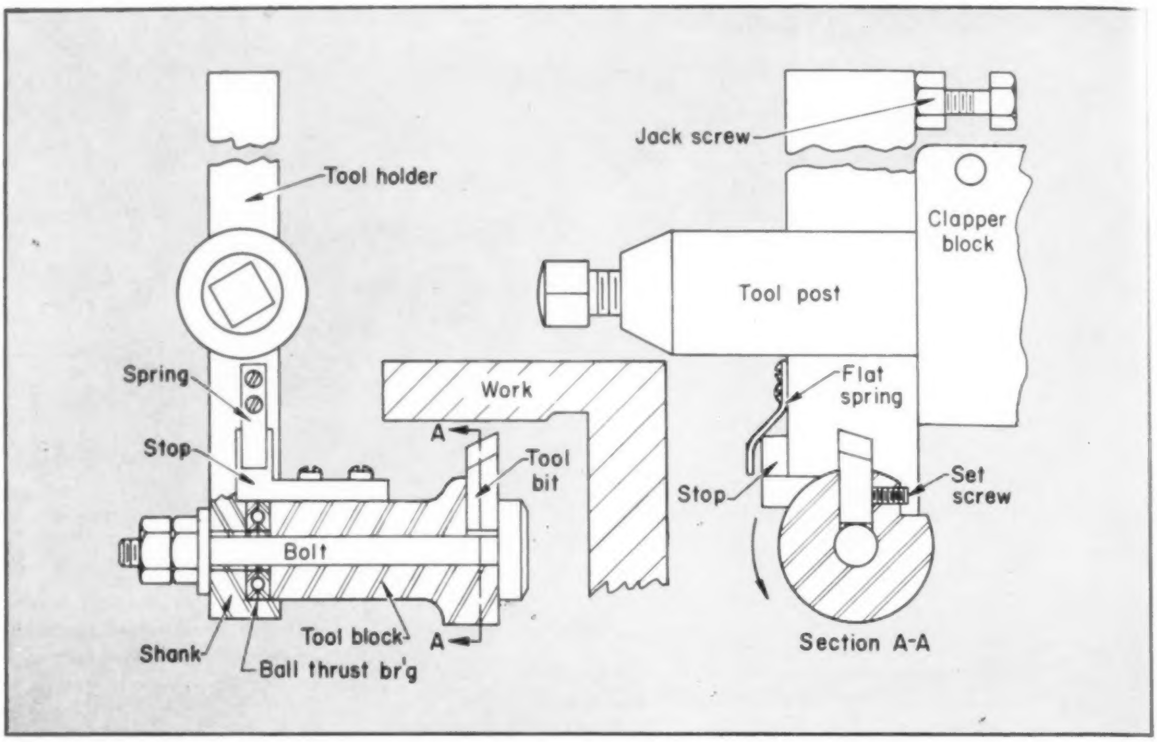
The thin electrical sheets that form a core will shift unless accurately located and securely clamped in a riveting die during assembly. Deviations in the edges of the stacked sheets result in core assemblies which are unsatisfactory for transformers and coils, and particularly for armature or pole cores in rotating electrical machinery.

One practical solution to this problem is shown in the accompanying riveting die design for positioning, clamping and removing a magneto core.

With the die in a press, the operator places the specified number of blanked laminations for a magneto stator core between stationary and movable nest plates. He then inserts 3 pins in the assembly holes in the stacked laminations and swings the handle to the right to align and firmly clamp the laminations between the nest plates. The toe of the handle bears against a clamping post, preventing any movement of the laminations during the impact of riveting.

On the downstroke three punches, installed in a punch holder, as shown in the detail, upset the upper ends of the three pins while the stack is vertically compressed by an insert shaped to the contour of the laminations. At the same time, the lower ends of the pins are peened over in the spherical depressions in the die, shown in the front elevation.

On the upstroke, the handle is swung to the left, rotating the movable nest plate around its pivot and against the spring-loaded rod shown. A knockout is actuated through the linkage to eject the assembled pole piece from the front of the die. The linkage is returned to the loading position by the spring. This design has proved highly successful in this application and it can also be adapted for use as a holding fixture for other operations such as drilling and tapping.



Toolholder for Undercuts

Planing the undercut on an overhanging part of a casting with a standard toolholder is a difficult operation. This is particularly true if the overhang is of considerable width. The special toolholder illustrated was built to plane the rack seating surface on the underside of engine lathe beds. It has been used successfully on this and similar jobs.

To construct the device a cylindrical tool block is mounted to a heavy rectangular toolholder shank with a strong binding bolt. A ball thrust bearing is inserted between the tool block and shank so that the tool block can make a partial rotation on the back stroke, thereby preventing the tool from rubbing against the workpiece.

An L-shaped stop block is screwed to the tool block to hold the tool in cutting position on the forward stroke. A flat spring against this stop rotates the tool block back to cutting position after each relieving movement.

The toolholder shank should be blocked tightly so that the clapper block is unable to swing in the usual manner. This can easily be done by use of a simple jackscrew made of a cap screw and nut.

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Small Feeler Gages

Feeler gages in sizes under 1/8-inch for many jobs are required in special shapes to fit in contoured parts, blind holes, etc. For this purpose the following tool may be made quickly and inexpensively.

The gaging portion consists of carbon drills because they can be purchased in a wide range of sizes. Drills of the proper size for the "Go" and for the "Not Go" side of the gage are bent to suit the gaging job to be performed. The drill ends are then assembled to a standard gage handle and plastic is poured around the flutes to hold the drills firmly in place.

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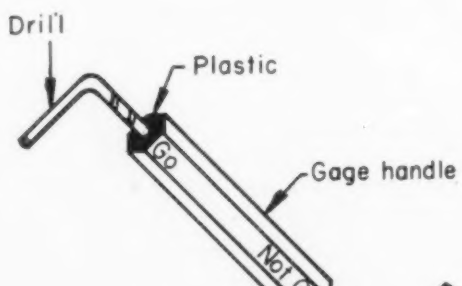

how to choose short-run cams

for automatic screw machines

By Allen Johnson*
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WHEN ORDERS of screw machine parts are to be filled, often there is insufficient time to permit securing cams designed for the job. Also, since such orders are usually of a short-run nature, inclusion of cam costs would often result in a high per-piece cost. Production of such parts on hand screw machines is uneconomical because of high labor cost.

The solution to this dilemma involves the use of "pick-up" cams—cams designed for a previous job whose depths of cuts are similar to those on the one at hand. Even this solution poses some difficulties. The selection of the pick-up cam cannot be haphazard if satisfactory parts are to be produced. On the other hand little time can be wasted in experimenting or the order will be lost through inability to meet rush delivery demands.

Care must be exercised in the choice of pick-up cams and machine cycle time to insure that tools are operated at proper speeds and feeds and that taps and threading dies are followed closely but without crowding.

Seldom will all of the lobes on a pick-up cam produce ideal feeds for each tool involved. More often, a compromise cycle time must be chosen so the heaviest feed encountered may be a little greater than ideal in order that the lightest feed will not be too fine. Usually, the characteristics of one lobe will dominate the picture. This is especially true when a part is to be tapped or threaded. Whereas some variation in feed can be applied to ordinary cutting tools, the pitch of a thread establishes the cyclic speed of the cam and the resulting feeds of the other lobes must fall within the permissible range for each respective tool used.

A hypothetical component for which cams were designed to produce the part on an automatic screw machine is shown in *Fig.* 1. Included in the illustration are the sequence of operations and the resulting cam layout data. For the sake of brevity, the cross slide operations that are not pertinent to the problem are omitted.

The calculations for this part are performed as follows: The nature of the part dictates the sequence of operations and the amount of throw for each tool, while the feeds per revolution are based on standard practice. The throw divided by the feed establishes the total number of revolutions required by each tool to complete its work. Their sum total represents the productive part of the cam.

The nonproductive or idle sections of the cam are dependent mainly on three things: (1) the cut-back of the lobes as required by each respective tool, (2) the amount of drop from each lobe to the next, and (3) the shapes of the drops. These are relative to the machine cycle time and are best obtained with the aid of cam layout templates.

When the number of hundredths of cam cycle for each idle section is determined, their total is subtracted from 100 to find the number of productive hundredths (shown in white). This figure divided

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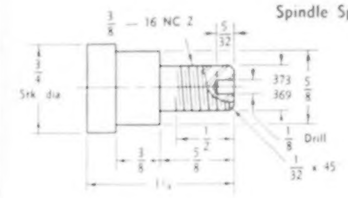
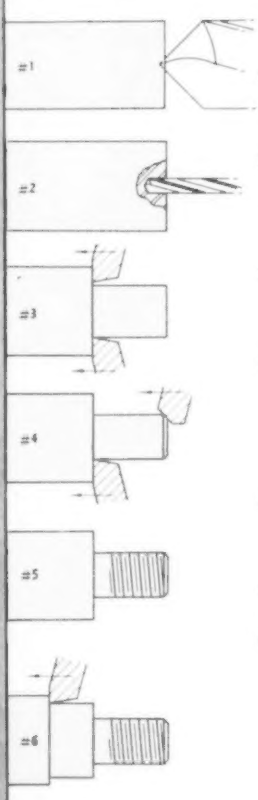
PART A

Spindle Speed 445,1180





	Basic Data		Calculations: Preliminary		Calculations: Final			
	Throw (inch)	Feed (ipr)	No. of Rev. at Threading Speed	No. of Rev. at Constant Speed	Hundredths of Cam Cycle	Feed (ipr)	No. of Rev. at Threading Speed	No. of Rev. at Constant Speed
Feed stock					3			27
● SPOT	.080	.003		27		.003		27
Index turret					3			27
● DRILL	.176	.002		88		.0019		90
Dwell					• ½			4
Index turret					3			27
● ROUGH TURN	.625	.0045		139		.0044		142
Index turret					3			27
● FINISH TURN AND CHAMFER	.645	.0035		184		.0034		187
Dwell					½			4
Index turret, reverse spindle and change speed					3			27
● THREAD ON	.500	.0625	8	21		.0602	8.3	22
Reverse spindle and change speed (internal)					—			
● THREAD OFF	.562	.065		9		.0635		9
Index turret					3			27
● TURN	.395	.003		132		.0029		134
Dwell					½			4
Cutoff: Internal	.290	.002		—				
Cutoff: External	.160	.002		80		.0019		82
Clear					2			18
Total productive movement in revolutions				680				
Total idle movement in 100's					21½			
Total productive movement in 100's								
Totals for one complete cycle				867	100			
Total revolutions adjusted to manufacturer's table								885

Fig. 1. Diagram of automatic screw machine operations with data necessary for producing a typical part. Productive hundredths shown in white.

into the total productive revolutions and multiplied by 100 produces the total number of revolutions at constant speed required to complete one piece.

The number of revolutions for "threading on," calculated at threading speed, is converted to a proportionate number at constant speed, since this is the basis on which the manufacturer's tables are predicated.

Next, the total number of revolutions for one cycle is divided into 100 and then multiplied by the number of revolutions at constant speed for each tool to obtain respective amounts of cam style to the nearest quarter-hundredth, as shown in color.

The preliminary calculation for the total number of revolutions for one cycle is adjusted to the nearest figure in the manufacturer's table. This amount is then apportioned to each productive and idle section according to its portion of cam cycle in hundredths. The adjusted values for the feed of each tool are obtained by dividing the throw by the respective adjusted number of revolutions.

A component which can be produced by a pick-up cam is shown in *Fig.* 2. The sequence of operations and cam layout data are calculated on the basis of the tool slide cam for Part A. The data appear incomplete only because such data, when pick-up cams are involved, are not figured in entirety, but only relative to the data for the part from which the tool slide cam is borrowed.

The two workpieces appear at first to be dissimilar, but a comparison of depths and lengths of cuts is the key to their resemblance. The tooling setup for Part B can hardly be termed ideal with one tool position remaining idle, but this expedient is neces-

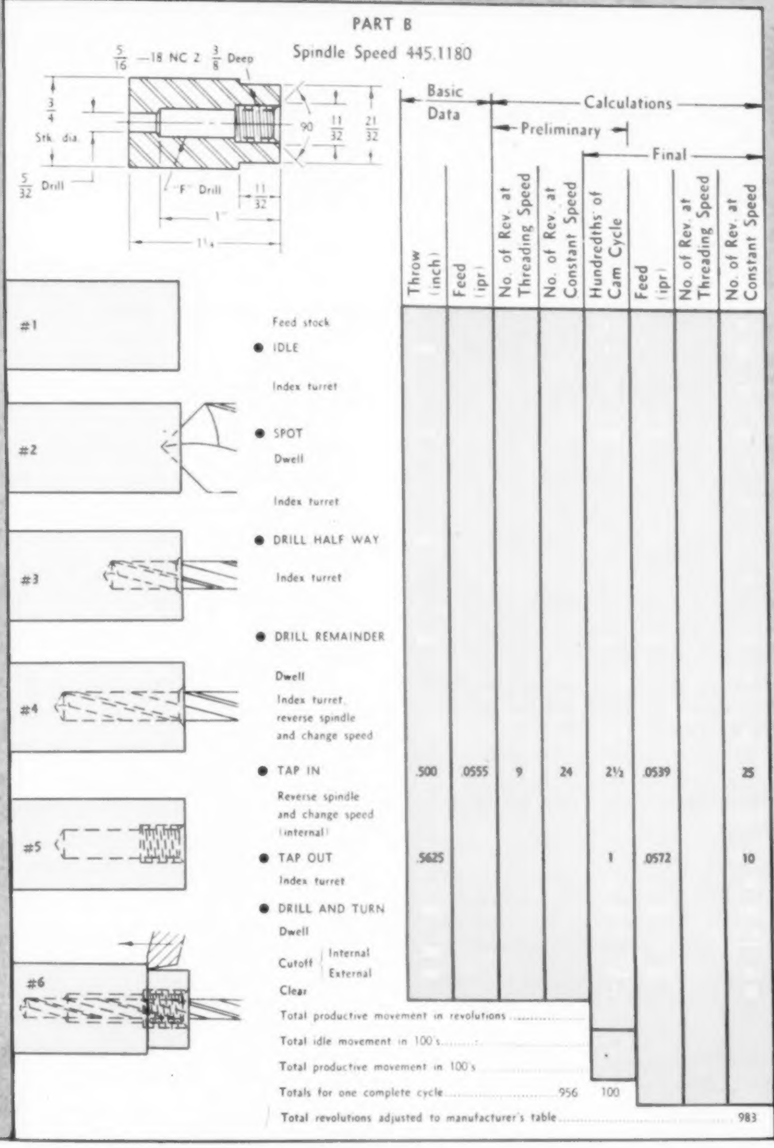


Fig. 2. Diagram of operations and data necessary for producing another part by adapting the cam used for the part in *Fig.* 1. Values for feed (ipr) for Part *B* are in white.

sary because of the nature of the lobes on the borrowed cam. *Fig.* 3 shows clearly the change in application of the cam lobes from Part A to Part B.

Because both parts are threaded, the threading lobe will be the dominating factor in establishing the machine cycle time for Part B. Note that the pitch of the thread is 16 threads per inch (0.0625 inch) on the original part and 18 tpi (0.0555 inch) on the new one. Obviously, if the tap for Part B were advanced at the same rate of speed and feed as the die for Part A, a crowding condition would occur, resulting in tool breakage and scrap production.

Formulas have been developed to facilitate the choice of feeds and machine cycle times which will insure good production, without using cut-and-try techniques, when applying pick-up cams to a job. These formulas are based on the following definitions, referring to *Fig.* 4:

A = Threading spindle speed desired, rpm

B = Top spindle speed desired, rpm

C = Revolutions per hundredth of cam cycle at threading speed

D = Revolutions per hundredth of cam cycle at constant (top) speed

E = Revolutions to make one piece (preliminary calculations)

F = Feed per revolution desired, ipr

G = Revolutions to make one piece (from mfr.'s table)

L = Length of lobe, hundredths of a circle

R = Rise per hundredth on pick-up cam, (T/L)

T = Total throw of lobe, inch.

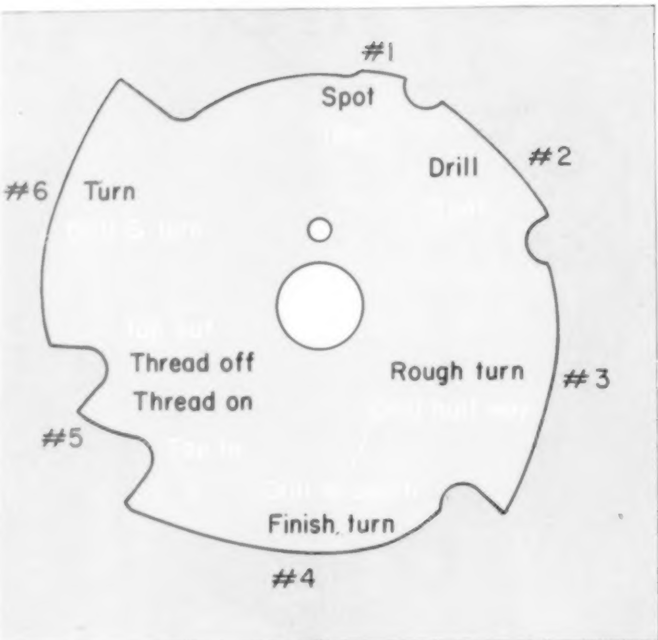


Fig. 3. Cam template designed for part-piece illustrated in *Fig. 1*. Operations in white are for producing part-piece shown in *Fig. 2*.

In preliminary calculations the formula for threaded parts is as follows:

$$C = \frac{R}{F}$$

$$D = \frac{C}{A} B$$

$$E = 100\ D$$

In the final calculations, using G = next higher value than E in manufacturer's machine cycle table,

$$D = \frac{G}{100}$$

$$C = \frac{D}{B} A$$

$$F = \frac{R}{C}$$

The value of F at this point should be slightly less than in preliminary calculations to avoid crowding of tap or die.

For parts not threaded, the preliminary calculations are as follows:

$$D = \frac{R}{F};\ E = 100\ D$$

For final calculations, using G as the nearest value to E, the formulas are:

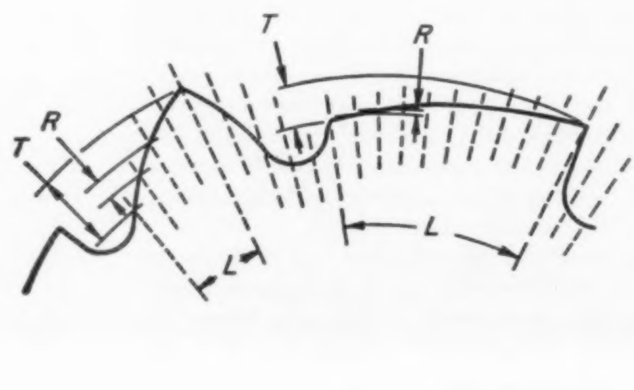
$$D = \frac{G}{100};\ F = \frac{R}{D}$$

These formulas, applied to Part B, are discussed in the following: Because of the tapped hole, the threading lobe is the governing factor in the problem. Therefore, the only preliminary calculations appearing in Fig. 2 are those for the threading lobe. After the spindle speeds are chosen and the desired feed per revolution (pitch of the thread) is entered, the total number of revolutions to make one piece is found to be 956. The next higher value in the manufacturer's table (G) is 983. Based on this figure, the final or actual value for F on the threading lobe is found to be 0.539 ipr. Since this is slightly less than the actual pitch of the thread, there will be no crowding of the tap, and the cycle time for 983 revolutions per piece (50 seconds) can be specified for Part B.

The value for F for each respective tool is then figured and entered (shown in white), not only for future reference, but to be sure that the chosen pick-up cam will be suitable for the entire job.

From this application some of the limitations for applying these formulas are apparent. The extent of limitations is governed largely by the inventory of cams on hand. Also, within these limitations, the latitude of possible applications is smaller for threaded than for nonthreaded parts. Despite such restrictions, the use of pick-up cams by means of these formulas is justified even if a slightly longer cycle time per piece results. This is especially true when the costly alternatives are considered.

Fig. 4. Sketch showing designation of cam elements for calculating operational data: *L* is length of lobe in hundredths of a circle; *R* is rise per hundredth on pick-up cam; *T* is total throw of lobe.



Low Heat Joining Saves Tools

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LOW HEAT INPUT JOINING is a process of joining metals without heating the parent metal to its melting point. It is based on sound metallurgical principles and achieves bond strength by surface alloying instead of fusion. It has long been acknowledged that excessive heat is the cause of many joint failures. The joint itself may remain intact but failure may occur somewhere in the heat-affected zone as a direct result of the heat used during joining.

Obviously, the best possible joint would be one that could be performed without any heat at all. The parent metal would retain all of its original properties, there would be no heat-affected zone and there would be no change in the metallurgical characteristics of the metal.

No adequate method has yet been discovered for obtaining the desired strength in a joint without heat, but low heat input joining provides a means for joining metals, *Fig.* 1, with the minimum possible heat.

High bond strengths are possible with this process, depending upon the choice of filler metal. Continuing research has determined the groups of metals which possess the strongest affinity for each other. Parallel research has indicated the group of metals which, when alloyed together, will combine best strength characteristics, highest affinity and lowest possible melting point.

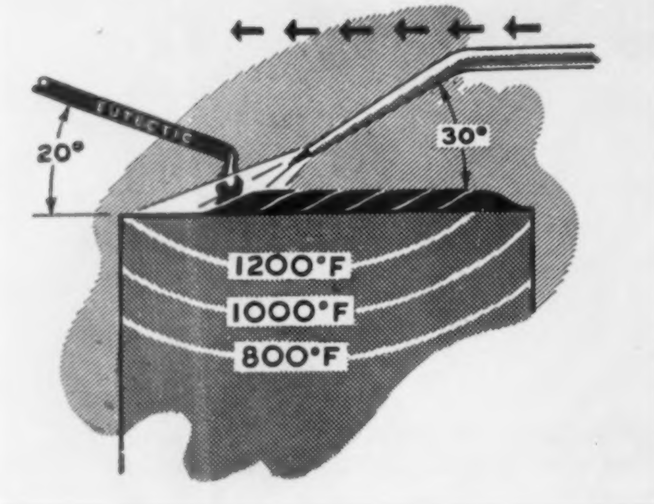
Melting point of such a filler metal can be as much as 1000 deg Fahr below the melting point of the base metal. When this molten filler metal contacts the heated base metal a new alloy is formed at the interface. The filler metal penetrates the base metal and the strength of the joint equals the strength of the new alloy. This alloy could conceivably be stronger than either the base or filler metals.

Copper melts at 1981 F, silver at 1762 F. It would seem to be impossible to join copper to silver at a temperature below 1500 F because this is far below the melting point of either metal. However, if a piece of copper foil 0.004 inch thick is sandwiched between two silver sheets 0.080-0.120 inch thick and placed in a furnace maintained at 1450 F, the two silver sheets will be joined.

This is possible because a silver-copper alloy has a melting temperature of 1432 F. When the sandwich assembly reaches this temperature, surface al-

Fig. 1. Leather cutting die was incorrectly aligned and a large piece broke away. Repaired and back in operation the next day, the die has been used for over six months without showing signs of failure.

Fig. 2. When the torch is held at a low angle base metal heat absorption can be controlled. Only the surface is brought to bonding temperature.



loying takes place and the copper combines with the silver to form an alloy. This is the principle of low heat input joining.

This process uses every possible means to reduce to the minimum the heat absorbed by the parent metal. The positions with which the rod and torch are held, *Fig.* 2, have a distinct bearing upon the result. If the bonding temperature of the parent metal is 1200 F, there is no need to raise the surface temperature much beyond this point. If the torch is held vertically, pouring heat into the base metal, the bonding temperature will be exceeded and heat input will not be confined to a shallow zone. The ideal method is to heat the surface of the metal only.

The torch should be held at a low angle to the face of the work and directed on deposited metal. The alloy should be held in the path of the flame so that it shields the base metal to some extent. Sufficient heat will by-pass the alloy to keep the base metal at the required temperature and, by raising the rod occasionally, the amount of heat contacting the base metal can be controlled.

These techniques are of utmost importance when dealing with heat-treated steel. Excessive heat during joining operations can ruin a tool or necessitate lengthy and expensive subsequent hardening operations.

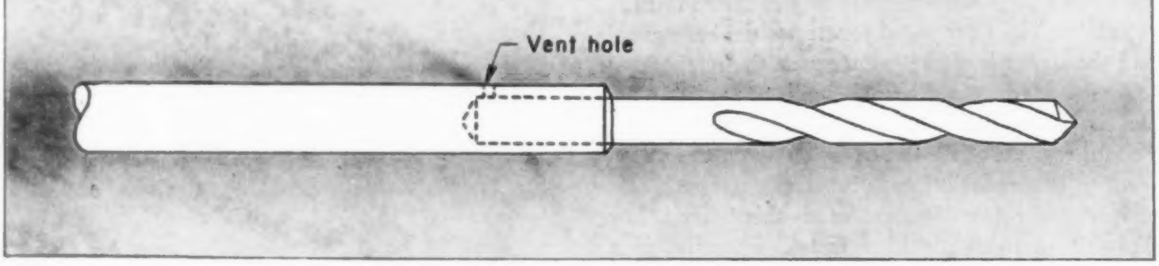
When shank extensions have to be joined to taps and drills, it is advisable to use as little heat as possible. Everything else being equal, the method using the lowest heat should be selected. A joining technique which has proved effective is illustrated in *Fig.* 3. The extension shank is drilled to the required depth and a small vent hole is drilled as shown. Eutec-TinWeld, a powdered solder mixed with its complementary flux to form a paste, is applied to the interior of the hole. The drill is inserted and rotated to uniformly coat it and then the shank is heated. High capillarity of the solder-type alloy ensures complete coverage and its low melting point, 350 F, avoids any possibility of damage to the tool.

Many joint failures can be traced to incomplete cleaning of the joint areas. Previous mechanical or chemical cleaning is no guarantee that the joint is clean at the time the filler metal is applied. Aluminum has such a high affinity for oxygen that oxides form almost as rapidly as they are removed. When metal is heated it becomes increasingly susceptible to oxidation; thus, although the metal may have been clean at the outset, before it reaches the bonding temperature it is oxidized again and a successful joint cannot be formed.

Some metals, such as chromium, form refractory oxides which have considerably higher melting points than the base metal. If these oxides are not removed, the parent metal will melt long before the melting point of the oxide has been reached. This factor is particularly evident when aluminum is joined. Aluminum oxide has a much higher melting point than aluminum. The metal does not show heat color so no warning is given before the part suddenly collapses.

An efficient flux must be able to dissolve surface oxides and form a film that prevents oxygen from combining with the metal during the joining operation. If this is accomplished, the filler metal will contact a clean surface and be able to surface alloy with sound, uncontaminated metal.

Fig. 3. Drill joined to shank extension by low heat input method using paste solder.



it is rare that a general-purpose flux can be effective. If the constituents of a filler alloy have to vary to give maximum bonding efficiency, then the constituents of the flux have to vary also. This means that the best results will be obtained with an alloy specially formulated for the metal it is to join and a complementary flux.

This increases inventory but a large and varied inventory can be tolerated if it will help to reduce production costs or salvage valuable tools that might otherwise be scrapped.

Most tools can be repaired if the correct materials and procedures are used. When breakage occurs in the flutes of a twist drill, for example, there is no need to scrap the drill. It can be repaired easily with a high-strength thin-flowing alloy. The broken ends are ground square and the grinding wheel is run around the edges. This is termed "breaking the edges" and plays an important part in the efficiency of the repair. A certain amount of flexibility is necessary under operating conditions and, when the corners are broken, a small gap or V is formed. This minute gap is filled with alloy during repair and, apart from strengthening the bond immeasurably, it gives flexibility to the tool which prevents sudden breakage under stress.

Faces of the break are fluxed with a temperature indicating flux. The drill is clamped into a fixture to maintain alignment and heated with an oxyacetylene torch set for a neutral flame. The flame should be directed upon the metal surrounding the break so that the heat can be conducted to the flux. Melting point of the flux should be approximately equal to the bonding temperature of the base metal. When heat is conducted to and melts the flux, it is a sure indication that the base metal in the joint area has reached the bonding temperature.

When the flux starts to flow, the special welding rod should be applied to the joint area. The smallest possible amount should be used and heating should be continued until filler metal is seen to penetrate the joint. It appears as a neat fillet on the opposite side. High capillarity of this alloy permits it to flow through the tightest joints and, since it has a tensile strength up to 100,000 psi, a simple butt joint is all that is needed, *Fig.* 4.

Removal of any filler metal that remains on the flutes of the drill is the only finishing required. Even this can be avoided when the operator has learned to judge the amount of filler metal needed to penetrate the joint.

In the past, when a die was badly broken it was usually pronounced unrepairable and consigned to the scrap heap. Today many of these dies are repaired and back in service a few hours after breakage has occurred.

When a leather cutting die was incorrectly aligned, a section measuring $1\frac{1}{2}$ inches in width by $\frac{1}{2}$ inch deep was broken off. Formerly this would have been regarded as scrap material and a delay of three months for replacement would have been necessary. This die was repaired and back in operation the next day.

It was built up to within $\frac{1}{8}$ inch of the cutting edge with EutecTrode 680 DC. This was applied using reverse polarity to keep heat input to a minimum. A $\frac{3}{32}$-inch electrode was used for the build-up with the welding machine set at 50 amp. This is considerably below the amperage necessary for conventional electrodes and reduced heat absorption still further. Final beads were deposited with EutecTrode 6 HSS to give wear-resistant properties required by the cutting edge.

Initial deposits had high wear and impact resistance and acted as a cushion. They could absorb shock without cracking, which the harder final overlay could not do. This technique can be used to advantage for many similar purposes.

In tool and die repair, all efforts should be directed toward reducing the heat of application. When using an electric arc, amperages should be as low as possible, arc gaps should be short and the technique of skip-welding should be used to prevent local heat build-up. Sometimes a welder may find it best to work on several repair jobs at the same time. He can apply a few beads to one part and, while they are cooling, continue on the other parts. This prevents loss of time and all parts will remain relatively cool.

Peening will help to relieve residual stresses and slag chipping between passes will minimize the danger of slag entrapment. If these precautions are followed few failures will occur and low heat input joining may make the difference between a large scrap pile, with resultant replacements, and a scrap pile that diminishes instead of grows.

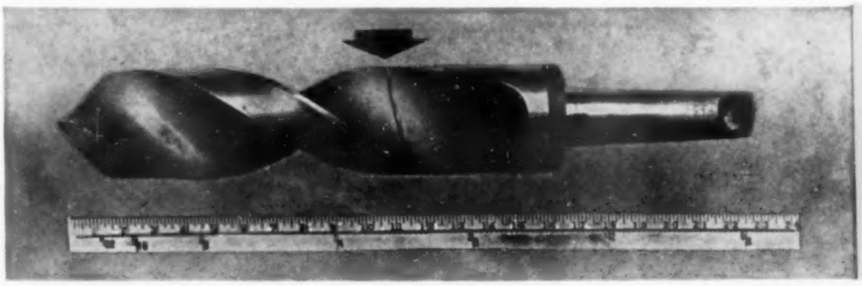


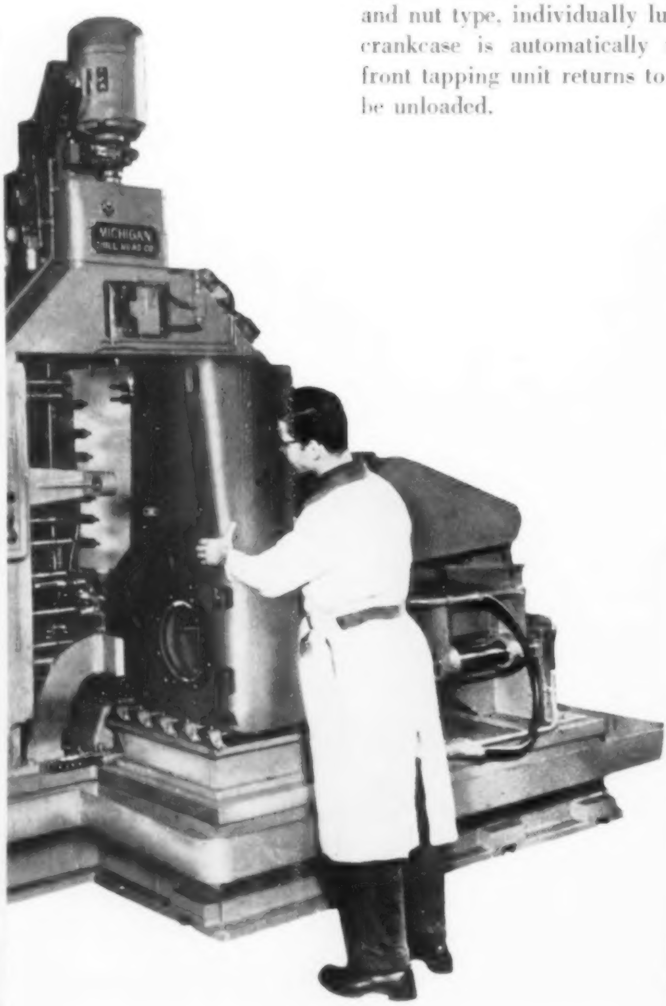
Fig. 4. Broken drills can be salvaged with a simple butt joint. High capillarity of special filler alloys permits perfect penetration of the joint.

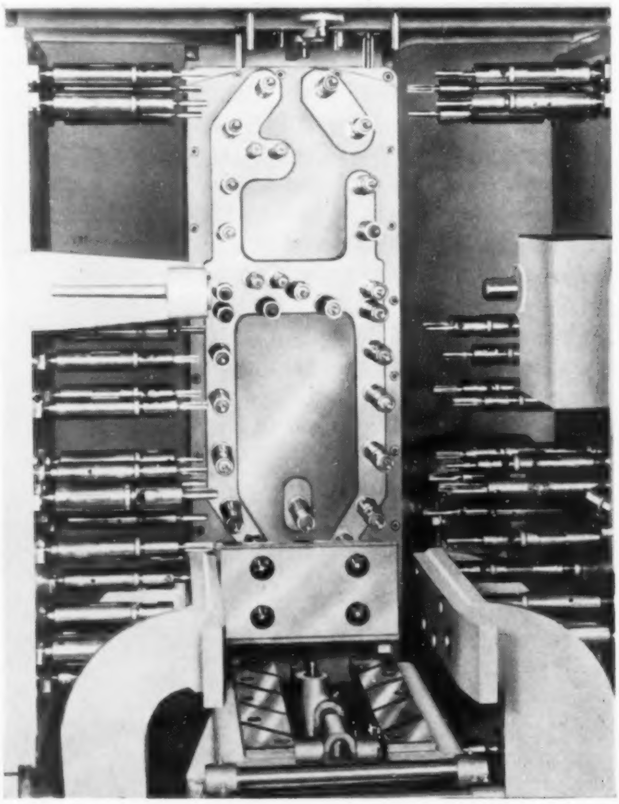
designed for PRODUCTION

Machine Taps Six Sides of Parts

IN ONE CYCLE, this machine taps a total of 97 holes in six sides of a tractor transmission case. Production rate is 40 crankcases per hour. The machine was designed and built by Michigan Drill Head Co., Detroit, Mich.

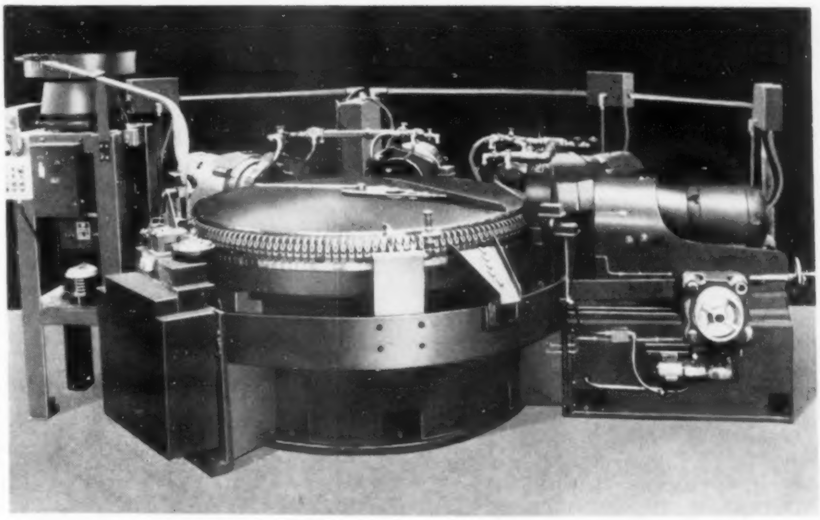
Crankcases enter the machine from a roller conveyor and the cycle switch is actuated. Locators align the crankcase; clamps secure it in position; the front tapping unit slides in front of the case, and all tap spindles start to rotate. All spindles are of the individual leadscrew and nut type, individually lubricated. When tapping is completed, the crankcase is automatically unclamped, the locators retract and the front tapping unit returns to its original position so the crankcase can be unloaded.





Machine Grinds Spherical Form on Tappets

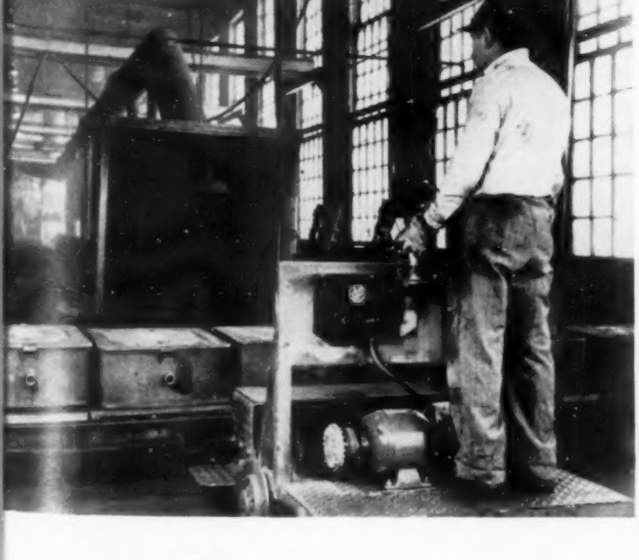
UNGROUND TAPPETS are automatically loaded from the hopper into V-shaped holding fixtures on the rotating table. Continuous rotation of the table passes each tappet across the faces of four horizontally mounted grinding wheels. The face of each grinding wheel is trued to a concave spherical shape with a radius equal to that desired on the tappet. The fourth wheel produces a surface finish of 10 microinches, rms. After passing the fourth head, tappets are automatically ejected into a chute.



HEADS of automotive valve tappets can be given a perfect convex spherical form by grinding on an automatic, four-head machine. Grinding heads are positioned radially from the pivot of the table and automatically feed toward the center to compensate for wheel wear.

Rotating table of this machine, built by The Motch & Merryweather Machinery Co., Cleveland, Ohio, has 160 fixtures and turns with a peripheral speed of 140 ipm. The double track loading mechanism inserts tappets into the fixtures two at a time and, at 100 percent efficiency, production is 4000 pieces per hour. Open fixtures are automatically flushed before reaching the load station.

Dry Clutch Smooths Power Transmission

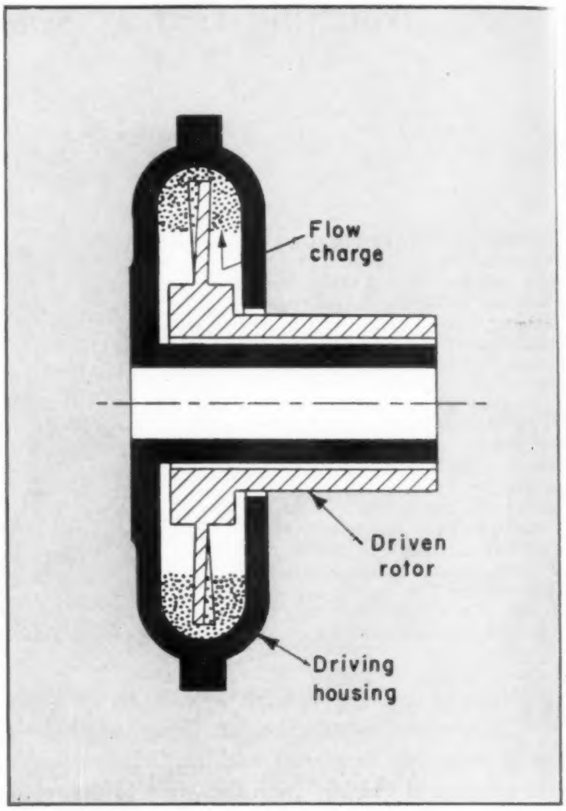


BASED on a principle that results in constant delivered torque for a given input speed, regardless of slip, the Flexidyne drive developed by Dodge Manufacturing Corp., Mishawaka, Ind., handles difficult starting and reversing problems, and provides shock and overload protection. Described as a "dry fluid drive," this unit consists of a driven housing and a rotor that is free to turn concentrically with the housing. Between the two is a quanity of small, spherical, steel shot that acts much

TWO TONS OF CARGO are carried by this foundry cart that is powered by a ¾-hp squirrel-cage motor. Power is delivered by a V-belt from the driven rotor to a speed reducer mounted on the cart drive shaft. The cart starts smoothly, travels at 160 fpm and stops smoothly under full load. It can be reversed or inched to exact location. This clutch permits use of small, inexpensive motors with low current demands and good power factor.

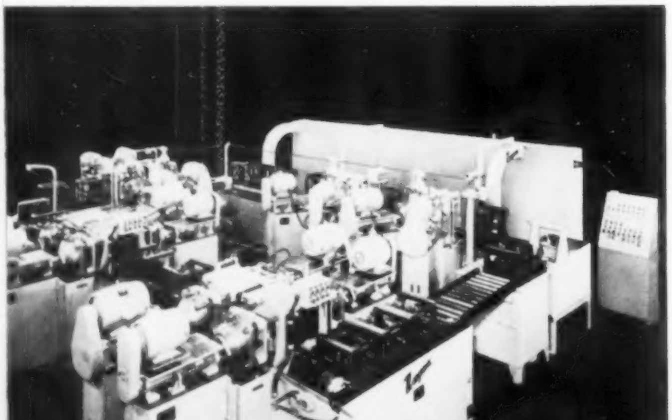
like a fluid. This "flow charge" is easy to seal in the housing, has high density and can stand high temperatures.

The quantity of shot in the housing determines the torque capacity of the drive. Because the quantity is easily changed, the exact required starting torque can be achieved. Accurate overload protection is achieved because slip can be regulated between 20 percent over full-load torque to peak motor torque. Current drawn during starting and overload is minimum because the motor is never reduced below 90 percent of synchronous speed. The Flexidyne will be used in drives involving heavy inertia and shock loads on such equipment as compressors, centrifuges, conveyors, crushers and machines used in metalworking.



DRIVE MOTOR is connected to the housing and starts the housing turning without load. The flow charge is thrown to the circumference of the housing, is compressed by centrifugal force and revolves with the housing. The rotor, connected to the load, is started and accelerated by the friction and wedging action of the flow charge. Rotor and housing rotate at identical speeds when running at normal operating speeds. During overload, the rotor slips relative to the housing. If a thermal switch is used, it will cut current to the motor if overload is prolonged.

Transfer Machine Features Safety



PALLET type transfer machine, drills, reams and taps holes on six faces of typewriter frames. The machine components form a square 25 feet on each side. Safety was one of the prime requirements of this installation designed and built by Zagar Tool, Inc., Cleveland, Ohio. A cord, following the perimeter of the machine at eye level, can be pulled at any point to stop the entire machine.

Stations are equipped with small, individual control panels so they can be operated independently during setup and repair. A large control console, near the load-unload station, indicates by flashing lights the status of every operation. The electrically powered, hydraulically operated machine is integrated so no operation or movement will occur until every station is ready to accept more work. Also, the machine will not operate until lubrication pressure reaches a predetermined level.

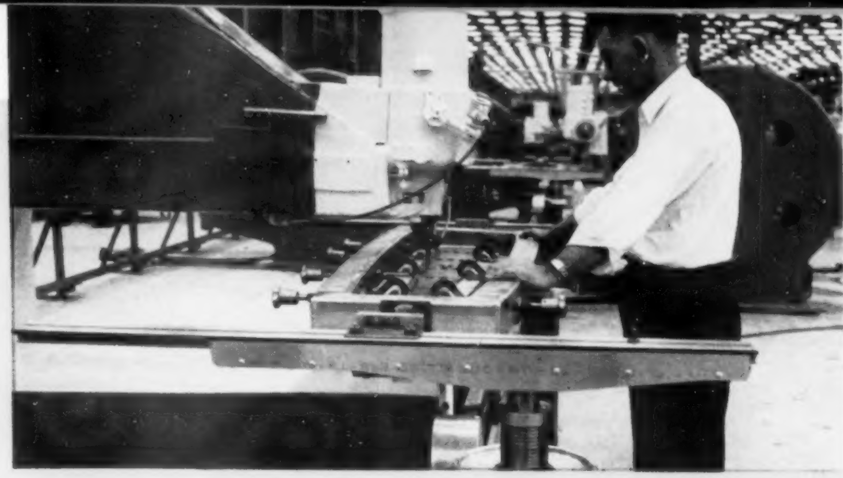


Fig. 1. Automatic riveting is made easy with fixture carriages running on a vertical track. Hook clamps operate through fixture frame to clamp and locate details.

Automatic Riveting Leads to Precision

By Clinton A. Bay
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RIVETING HAS LONG BEEN recognized as the most expensive operation in the assembly of an all-metal aircraft. The B-36 intercontinental bomber, for example, was put together with an estimated 3,200,000 rivets, screws and bolts. Installation of these fasteners required over 15,000 man-hours per plane and an investment of \$3.5 million in equipment. Four years ago, Convair started developing methods and equipment to reduce costs and improve quality of riveted assemblies. Emphasis was placed on automatic riveting.

Although fewer than 12 percent of applicable B-36 assemblies were reprocessed to automatic riveting, resulting savings proved worth of the methods. On current contracts, 70 percent of the fasteners are being installed by automatic, *Fig.* 1, or semiautomatic methods.

Economy is of primary importance but quality and precision have become major factors in the specification of automatic riveting. Hand assembly tolerances are no longer adequate. In the design and fabrication of the supersonic B-58 bomber, it became essential that perimeter ordinates of many riveted assemblies be held to tolerances of ± 0.004 inch. There were two known methods of accomplishing this precision in structural assemblies. They could be fabricated with an excess of material and be perimeter-milled to desired size and shape or all detail parts could be constrained throughout the assembly procedure to hold the normal "growth" within tolerances.

Investigation of the alternatives disclosed that perimeter-milling would require three times the available machine-shop capacity and manufacturing costs would be exorbitant. Spoilage during machining could not be anticipated but the potential for a high spoilage rate was great. Since most of the assemblies were riveted, it was decided to attempt to restrict those phases of riveting that induced assembly growth. Inaccurate fixture location, nonpositive clamping, misaligned holes, oversize holes and overdriving of rivets were the main causes of growth.

Improper rivet driving was the most common contributor to variation. Automatic riveting was established as the first corrective step, which avoided misaligned holes and overdriving of rivets. A series of tests was run on a sample assembly with 235 rivets so that hand bucking, compression squeezing, semiautomatic and automatic methods could be compared. Results were checked at 16 perimeter points, TABLE 1.

Hand riveting was done by semiskilled workers following approved techniques. After a few rivets had been driven, expansion of the lighter gage de-

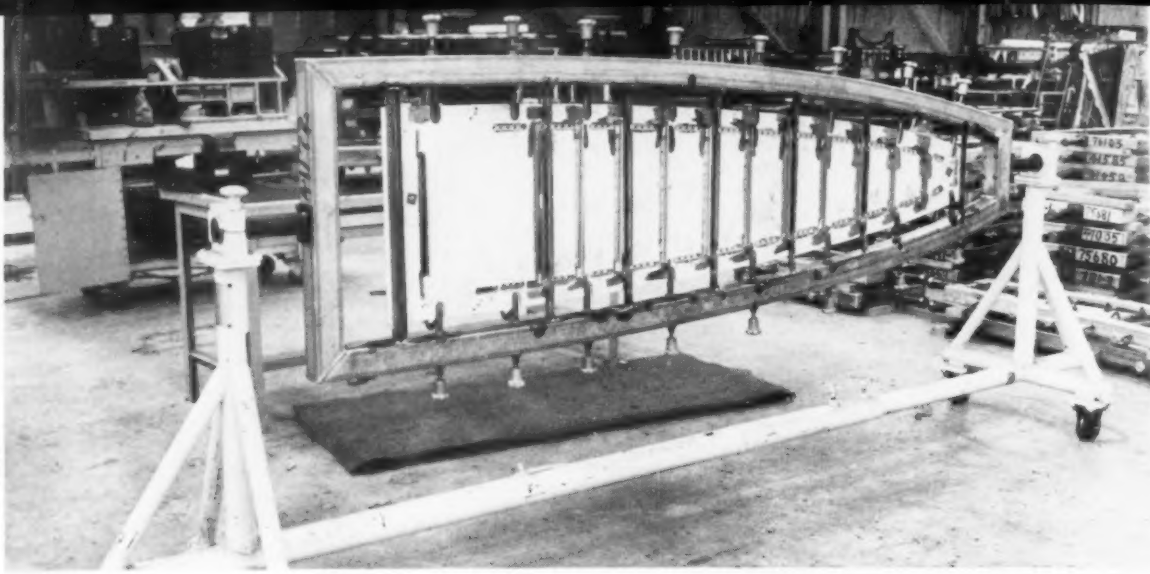


Fig. 2. (above) Picture frame fixture mounted on trunnion stand to achieve maximum mobility.

Table 1—Results of Tests of Four Riveting Methods

Assembly Method	Maximum Ordinate Variation (inch)	Minimum Ordinate Variation (inch)	Average Ordinate Variation (inch)	Bad Rivets (percent)	Bad Holes (percent)
Hand Bucking	+0.035	+0.007	+0.029	4.0	60.0
Compression Squeezing	+0.007	+0.002	+0.004	2.0	20.0
Semiautomatic	+0.005	+0.0005	+0.002	0.5	0.5
Automatic	+0.005	+0.0005	+0.0015	0.5	0.5

tail parts caused misalignment of the rest of the predrilled holes. These holes had to be drilled clean before rivets could be inserted. This method has been standard practice but is not recommended for highly stressed parts. Assembly by the compression squeeze method was similar in all respects to methods used for hand riveting except for heading of the rivets. Ordinate tolerances were improved because the heading pressure was controlled, and fewer holes had to be cleaned to permit insertion of rivets. TABLE 1 indicates the superiority of automatic methods.

Although the automatically assembled parts were within allowable tolerances established by the fixture, they were not within engineering specifications. The discrepancy existed in the conventional riveting fixture. This led to a program of fixture development.

Requirements of a precision fixture include: ability to locate and clamp all detail parts throughout assembly, positioning devices that can easily be set with an accuracy of ±0.002 inch, be movable from station to station, provide access to all work areas, be economical to make, require minimum floor and storage space, be made from a sketch rather than completely designed, include re-usable details, and be adaptable to automatic, semiautomatic or hand methods. Tests were made to determine comparative costs and accuracies of several types of riveting fixtures.

Results of these tests are shown in TABLE 2. The plate fiberboard fixture was basically a sheet of fiberboard with cutouts for the rivet pattern and stop blocks for locators. Clamping was accomplished by springs that held detail parts against the locator blocks. Made from a basic design sketch, this fixture was economical and accurate but required excessive time for setup and loading. Continued usage loosened the locators and accuracy diminished.

The fixture selected was a picture frame type. Mounted on trunnions, this fixture provides access to all work areas, is economical to build, is widely adaptable and can be made from a design sketch. By mounting the trunnion post holders on carri-

Table 2—Cost and Accuracy Comparisons of Riveting Fixtures

Type of Fixture	Design Time (hours)	Fabrication Time (hours)	Material Costs ($)	Fixture Weight (lb)	Assembly Accuracy (inch)
Table Top	47	151	295	370	±0.015
"A" Frame	51	187	310	350	±0.015
Plate Fiberboard	4*	64	115	140	±0.009
Picture Frame Steel	6*	115	420	185	±0.004
Picture Frame Aluminum	4*	81	434	70	±0.002

*Hours prorated from design time on basic fixture.

Fig. 3. Fixture storage area is drastically reduced because lightweight fixtures can be stacked. First vertical track leads out of this area to the left.

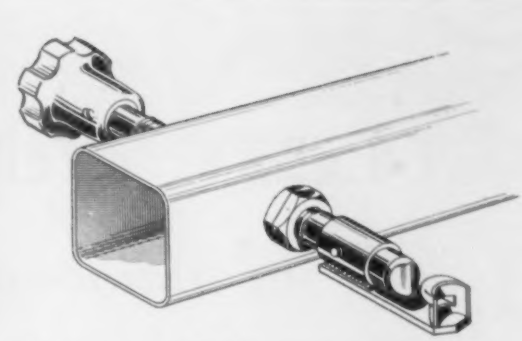


Fig. 4. Patented Siewek clamp adapted for channel sections. Alternate design is shown in *Figs.* 1 and 2.

ages, *Fig.* 2, and by reducing weight through use of aluminum structural materials, good mobility was obtained. These light fixtures can be stacked or stored in racks to save floor space, *Fig.* 3.

Clamps and locators remained a problem. They had to be precise, economical, compact, sturdy and adjustable. Since these requirements were not met by a commercial unit, the Siewek Tool Co. of Detroit started development of a clamp to be made from existing parts. Clamping and locating functions were to be combined in a single unit that would offer minimum obstruction to the working area. Units were to be mounted through the fixture frame to give greater machine throat clearance. Also, hook and locator units were to be made interchangeable so they could conform to the design of the assembly. An acceptable clamp was designed, *Figs.* 1 and 4. It supports the work, locates the mold line and positively clamps detail parts in position. Initial cost of these clamps is comparable to that for conventional clamps but, because of increased durability and re-usability, their ultimate cost is less.

Although eleven rivets can be set automatically for each hole drilled and rivet set manually, frequent setup changes for differences in rivet sizes nullifies this apparent advantage. It has been standard practice to group several riveting machines with each set up for a specific rivet size. Manual movement of parts from one machine to another is feasible, but manual movement of parts and their fixture is not.

To circumvent this, a work supporting and positioning carriage, for mounting on a vertical track, was developed. These carriages and tracks have proved efficient in the initial installation. Two 115-foot tracks are set opposite and parallel to each other. The first track starts at the fixture storage area, where fixtures are loaded onto the carriages. It then goes past the production part detail stock bins where details are loaded onto and secured in the fixture. This track goes by one automatic riveting machine where angle stiffeners are riveted to the webs.

The other track runs in front of five additional riveting machines, *Fig.* 5. Beyond the riveting machines are two pneumatic squeezers facing each other. A cleanup area, with all necessary portable pneumatic hand tools, is located at the end of this track. Transfer sections at each end of each track permit unit movement of loaded carriages.

Substitution of this method for present manually performed operations of drilling, slotting, spotwelding, trimming, tapping and countersinking holds promise for substantial reduction in fabrication time. Mechanization of these operations offers not only great potential savings in airframe manufacture but will increase uniformity and quality.

Fig. 5. Six automatic riveting machines are served by two 115-foot vertical tracks to combine all the results of investigation into better riveting methods.

care and use

of diamond wheels

The Industrial Diamond Association of America, through its committees and members, is constantly attempting to find better ways to use and care for diamonds used as tools. The most recent recommendations of the Association are summarized in this article.

INDUSTRIAL DIAMONDS are expendable but with proper care their service lives can be extended. It is unfortunate that some users have been urged to standardize on one type of bonded wheel, for example, because a specific combination of grit size, concentration and bond results in a wheel giving optimum performance for one class of grinding operations.

The diamond grinding wheel is in effect a multipoint tool. Efficiency of any diamond tool depends on the retention of a cutting edge that can be presented to the workpiece. There is one main difference between diamond wheels and single-point diamond tools. It is impractical to reset the diamonds in the wheel as is done with a diamond tool. Diamond wheels consist of a relatively large number of diamond particles bonded in a matrix and new points must be continually presented to the surface of the work.

Optimum condition would be for the work to abrade the diamond-wheel bond as the diamond particles wear and dull. If the bond would break down at a rate commensurate with the dulling of the particles, sharp grains would always be presented.

For most tool grinding, 100 to 120-grit wheels are used for roughing, and 220 and finer grits are used for finishing. Some manufacturers compromise and use 150 or 180-grit wheels for both roughing and finishing. This is feasible because it results in finishes that are satisfactory for most machining operations on standard products.

A wheel with medium concentration should be chosen when carbide tools are to be ground offhand. If small pieces of carbide are to be ground, higher concentration wheels would be more satisfactory. Higher concentration wheels permit use of lighter pressures, which will minimize heat checking of the carbide, but still give rapid stock removal. Fixed wheel grinding should be done with high concentration wheels as a rule. For 220 and finer grit wheels, medium concentration can be used economically.

Diamond grinding wheels are made with three different types of bonds: resinoid, vitrified and metallic. Each type has particular applications, although there may be some overlap. A metallic bond wheel is excellent for grinding glass, but neither resinoid nor vitrified bonds should be used. A resinoid wheel can be used to grind carbide wet or dry, and both vitrified and metallic bonded wheels have some application in grinding carbide.

The resinoid wheel will take more abuse than either of the other bonds and for this reason it is particularly applicable for carbide chip breaker grinding. Vitrified wheels have a tendency to be too brittle, and metallic wheels can glaze and cause heat checks. A high-concentration 180-grit resinoid wheel will give good results. Narrow wheels, about double the width of the chip breaker, should be used to reduce waste during truing, *Fig.* 1. If too wide a wheel is used, the entire middle section is lost during truing.

When multipointed tools are to be ground, the wheel shape shown in *Fig.* 2 should be used. This wheel illustrates the maxim that: with any carbide grinding, minimum contact area between wheel and work is desirable. When this wheel is used, grinding contact can be no more than the depth of the diamond section, $\frac{1}{16}$ or $\frac{1}{8}$ inch.

With precision fixed feed grinding, wheel life will be increased if downfeed per pass is limited to: 0.001 inch for 120-grit and coarser wheels, 0.0005 inch for 150 to 220-grit wheels, and 0.00025 inch or less for wheels finer than 220 grit.

Best results are obtained from resinoid and vitrified bonded wheels at speeds of 3500 to 5000 sfm. Higher speeds are recommended only where contact area between wheel and work is small or where form must be maintained on a shaped wheel. For metal bonded wheels, speeds of 3000 to 4500 sfm are best. Metal wheels, however, can have application up to 6000 sfm. Speeds higher than those recommended can cause burning of the resinoid bond, peening of metal bonds, and cracking or fracturing of vitrified bonds.

All diamond wheels operate at greater efficiency when used wet. Stream and mist cooling can be used effectively, and a felt wick in contact with the wheel is better than nothing. Any coolant solution should be chemically neutral and compounded to prevent rusting. A pH reading between 8 and 9 will lengthen the lives of resinoid wheels considerably.

It is good practice to check a diamond wheel after it is mounted. If runout exceeds 0.0005 inch for resinoid and 0.00025 inch for vitrified and metal wheels, corrective measures should be taken. The location of greatest runout should be determined and, with a block of wood interposed, it should be tapped lightly with a hammer.

Diamond wheels should be both trued and dressed. Truing restores the accurate shape of the wheel and dressing improves the cutting action. Diamond wheel dressing is actually a process of cleaning. A small amount of the bond is removed from between the diamond particles. One method of truing a peripheral type diamond wheel is by cylindrically grinding the periphery with a silicon carbide vitrified bonded wheel of soft grade and about 80 or 90 grit. Cup and dish type wheels can be trued and dressed at the same time by hand lapping. A cast-iron lap is used with an abrasive solution of 100-mesh silicon carbide in water.

Truing of diamond wheels should always be done wet, using water as the solution. If a diamond wheel becomes glazed or loaded by shank steel, it can be cleaned with a lump of pumice or a stick of fine, soft silicon carbide. A diamond wheel should never be trued with a diamond tool.

In offhand grinding, the tool should be oscillated across the entire face of the wheel to prevent grooving and avoid overheating. Diamond wheels should never be used to hog off broken or damaged tools.

Fig. 1. If carbide chip breakers are ground with too wide a wheel, a large amount of expensive diamond particles must be removed at each truing.

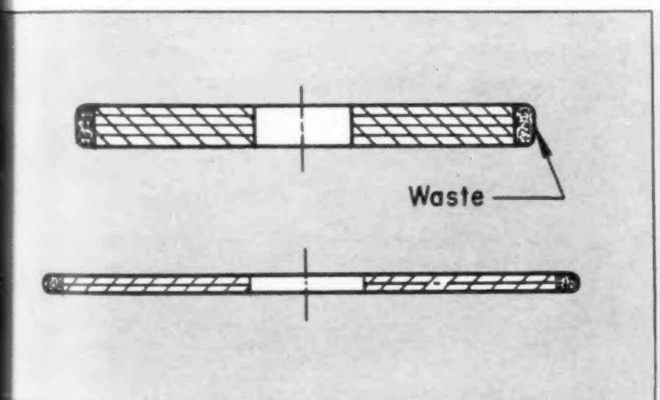
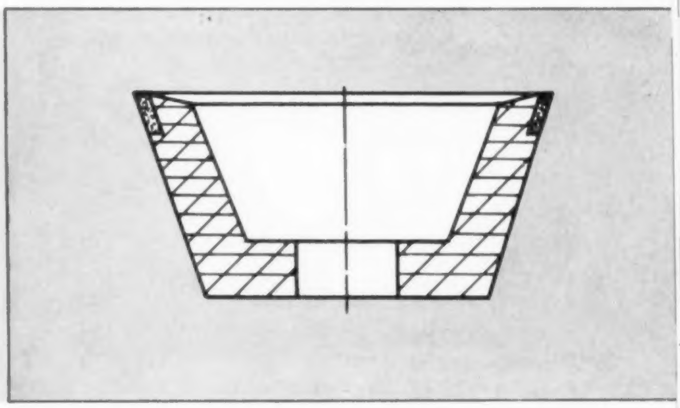


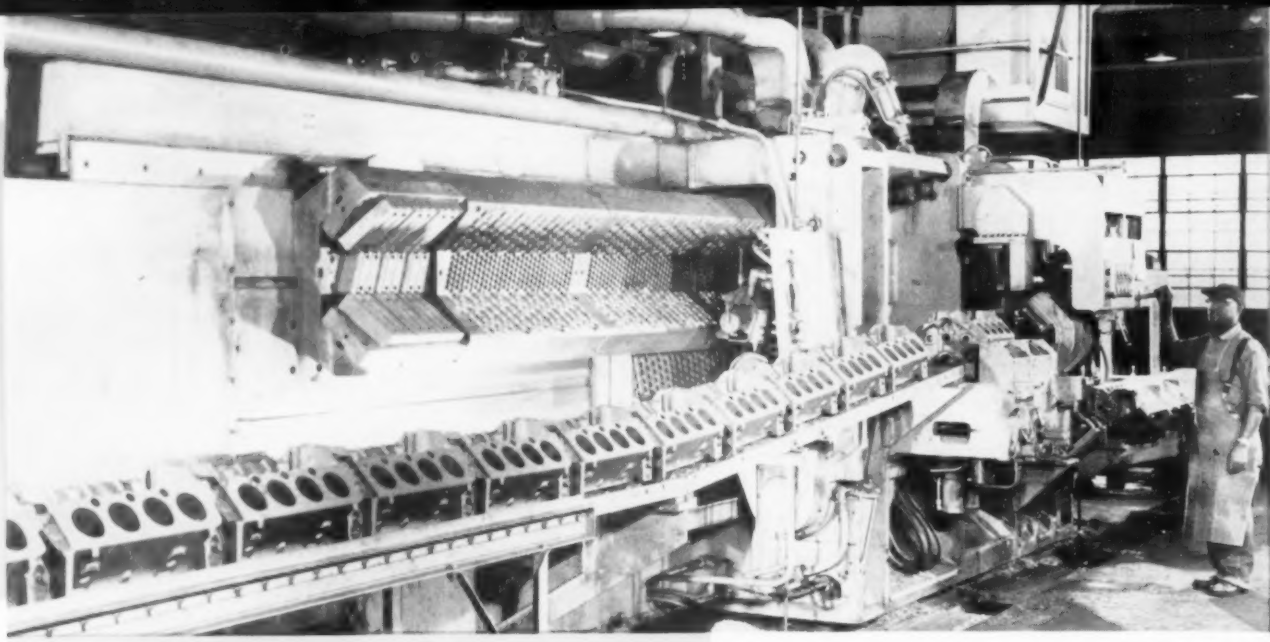
Fig. 2. Multipointed tools should be ground with this D11B wheel. Depth of the diamond section is usually 1/16 or 1/8 inch.



Good water solubles or mineral seal oils will keep the diamond wheel surface clean and cool. Plain water is a good coolant.

Bores on diamond wheels are made to plug gage tolerance of +0.001 inch to −0.000 inch. The wheel is then trued to the bore. After mounting, the wheel should be checked for runout, which should be no more than 0.001 inch. Fixed feed wheels should be mounted on an accurate adapter that is not removed until the wheel is completely consumed.

Hogging operations should be done with abrasive wheels or by sawing off the damaged carbide tip. Since steel will quickly load a diamond wheel, shanks under carbide tips should be relieved with a silicon carbide wheel so the diamond wheel will not contact them. Since diamond wheels can be severely damaged by dropping or improper storage, they should be kept in their original shipping cartons and assigned storage space in stock room, tool crib or drawer.

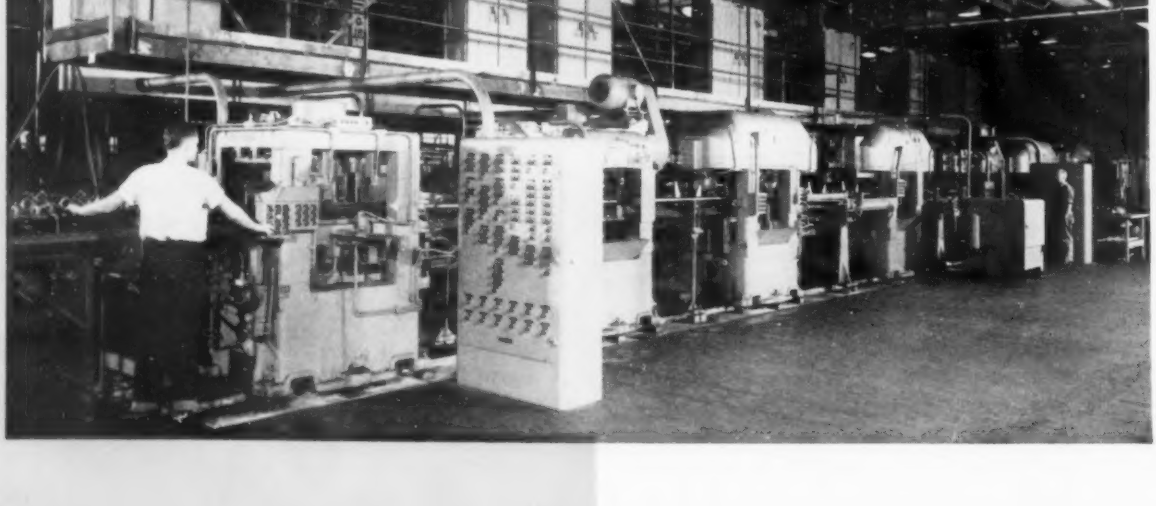


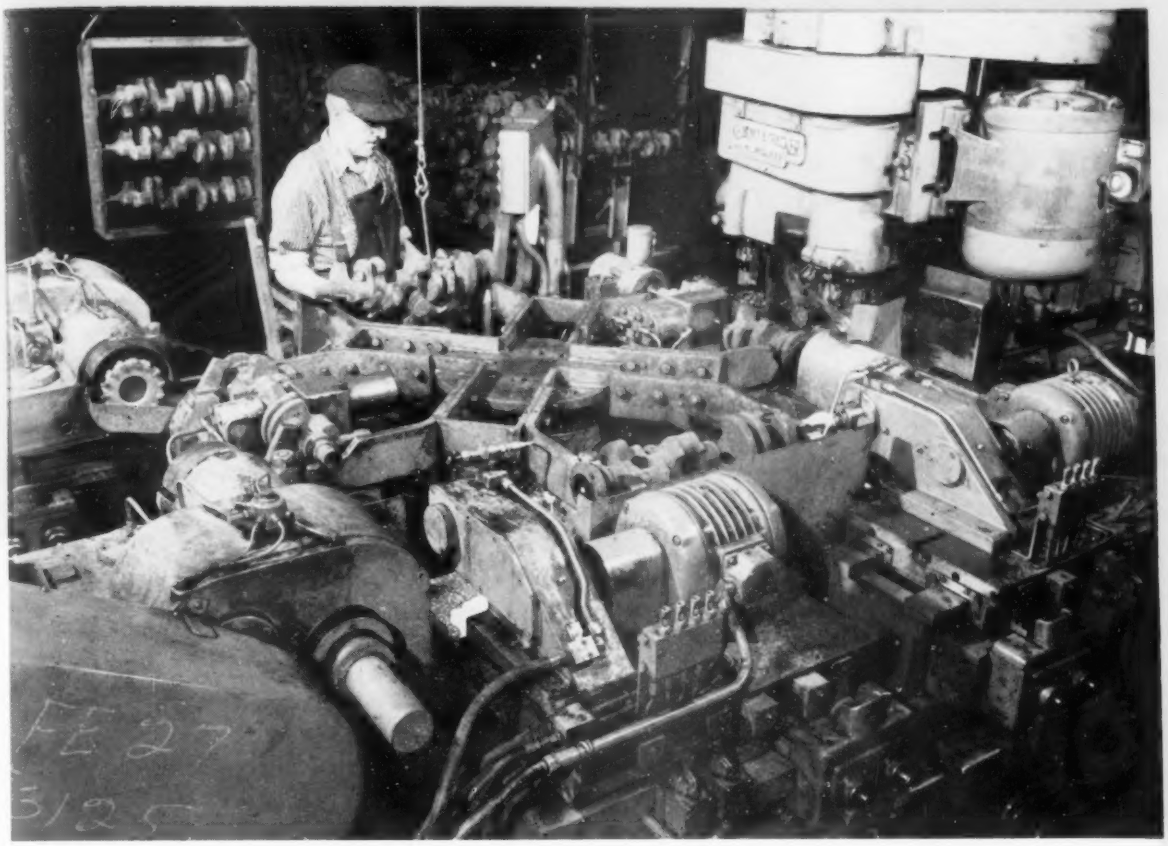
AUTOMATED ENGINE PRODUCTION begins with broaching of major faces of the block. Conveyor pushes rough casting on cradle (far right), which lifts and holds the block for facing of pan rails. A large jaw automatically turns over block and another mechanical arm positions it for shaving cylinder banks and top. Operations are timed so the first cradle jaw is loaded as a block is being finished by the backstroke of the top broach.

TOOLS at work

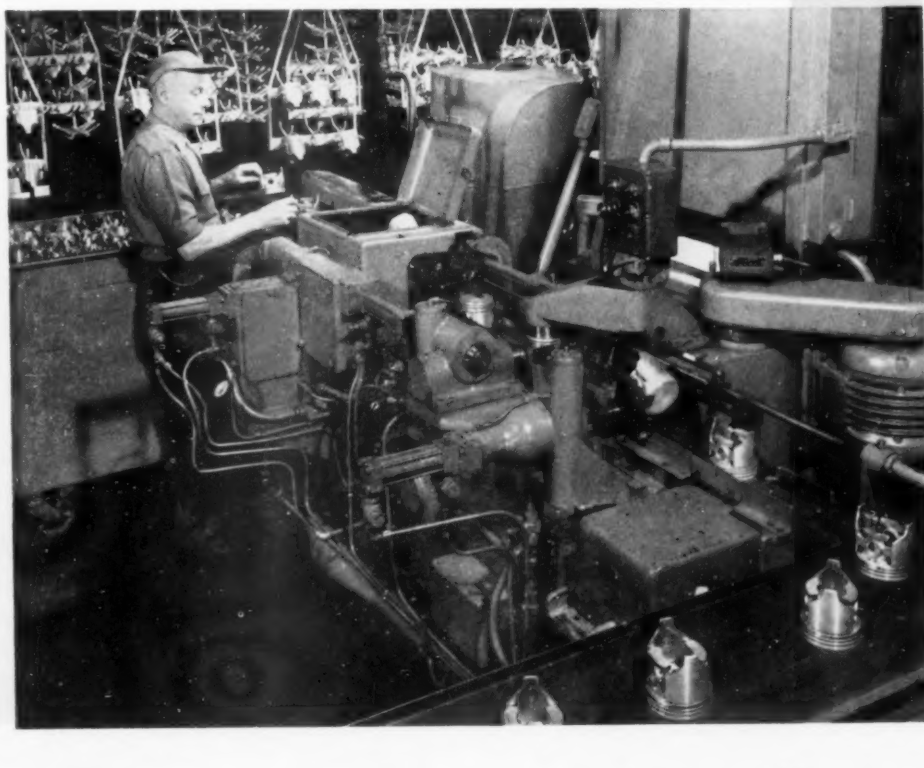
The following views from the Chevrolet V8 engine plant represent some of the most advanced developments in automated production. While they present only a cross-section of the large number of machines comprising the line, they are typical of the new concept of automatizing operations for improved product quality as well as for increased output and lower manufacturing costs.

LINE BORING bearing holes for camshaft and crankshaft is performed on this row of Ingersoll automatic transfer machines. At this point the bearing caps have been installed on the block. First operation, in station next to operator, is to inspect to determine bearing cap bolts have been properly torqued and openings are aligned. In subsequent stations operations include boring, reaming and counterboring, and side milling the bearing caps.





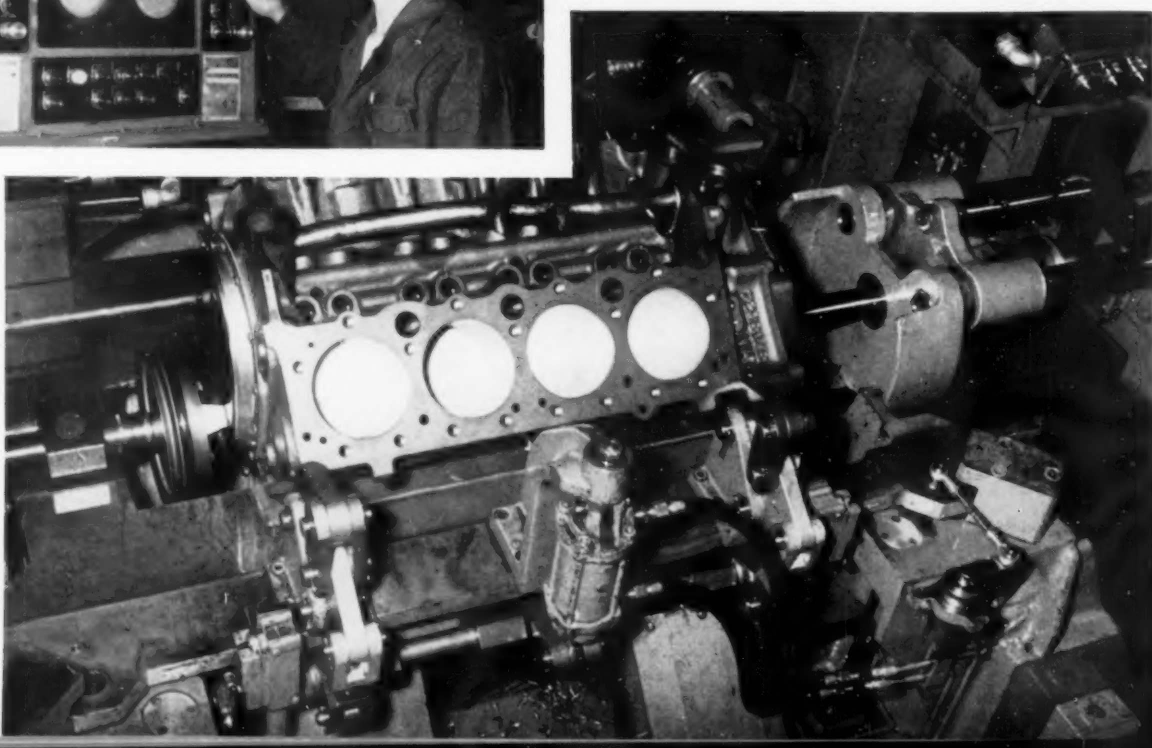
FOUR-STAGE K & T automatic indexing machine performs first operations on forged crankshaft. Operator loads machine in first position. Ends of crankshaft are milled in second station. Center holes are drilled in ends on next index while last station is a milling operation on counterweights. Machine is automated hydraulically.



PISTON BALANCING OPERATION is performed automatically. The operator loads pistons on the far end of the Morris machine from which it is conveyed to the scale. Overweight is automatically determined and recorded. The piston is then turned over and positioned above a milling cutter which rises and machines off the necessary amount. Other automatic scale rechecks weight which is held within ½ gram.

TOOLS at work

DYNAMIC BALANCING holds V8 engine imbalance to no more than ½ inch-ounce, assuring smooth performance. An intricate machine (top), developed by GM Research Laboratories tests engine with major reciprocating parts assembled, and turning at 700 rpm. An electronic memory storage unit records balance condition of engine (center). With engine at rest, electronically controlled drill unit then removes proper amount of metal from counterweights on crankshaft at a location to offset the imbalance (close-up).



TRAINING ENGINEERS

in a small organization

By Dwight Palmer and Robert Phillips
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CHARACTERISTICALLY a small firm uses generalized machinery and less special-purpose equipment than a large firm. The same principle applies in each category of its assets, and in particular, in administrative or executive skill, each of the key people may wear several hats. This may be particularly characteristic of the engineer because of his special educational background and training.

The engineer may fill several organizational niches, only some of which are of a purely engineering character. Equipped with less elaborate physical resources, often filling multiple jobs, the engineer in a small firm has more extensive training needs, which are also more elusive.

Fitting into the Organization

In the small firm, it is often more difficult to fit into an organization than in a larger unit. These difficulties stem from the nature of the small organization. Each function is less easily separated from others, because several individuals are carrying two or more responsibilities. As a consequence, the need for teamwork is extremely high. The specialist or technician becomes almost inevitably involved in problems of general management, as well as in problems particular to his own special area of competence.

Only recently has university training stressed the over-all management functions of the engineer. Many practicing engineers even today are less than adequately prepared to shoulder executive responsibilities. Others feel lack of self-confidence and finesse that makes them, too, desire in-plant training of a type to build new skills and confidence.

Another aspect of a job assignment is whether it is "staff" or "line." Distinctions between the two are sometimes far from clear in formal education. Moreover, many companies are careless insofar as this vital organizational distinction is concerned.

The young engineer in the small plant is frequently baffled by a resulting dilemma. In part, his duties are of a line nature where he is expected to be in command and give orders. Often within the same workday he may be required to function as a staff man whose essential contribution is understanding and know-how offered on an advisory basis only, without the issuance of orders.

Aid in distinguishing staff-line relationships might well be a unit of training for the small-plant engineer. Without it, he will probably be perplexed and have less usefulness to the company. Confusion of staff duties with line responsibilities has caused many an otherwise good executive to fail under fire.

Importance of Cost Analysis: A key function of the engineer is that of cost analysis. Costs are important to all supervisory and management employees. But they are especially important to the

Abstracted from paper 23C3D1, "In-Plant Training for Small Organizations," presented at the 23rd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

engineer because he is charged with the basic design for production.

One device to help him is Method-Time-Measurement (MTM). Such an approach is important in achieving economic product design and production methods. The MTM system can be used for cost analysis before the part is off the drawing board, giving the engineer an excellent guide along cost lines. The tool engineer, faced with the problem of making a selection between two jigs both of which can do the job, can more easily make the proper

Fig. 1. Engineering decisions in a small organization often involve informal conferences such as this with various executives.

selection if he has training in cost analysis.

Similarly, all of the industrial engineering functions, such as plant layout, work place layout, material handling, assembly lines and selection of equipment—which the small organization engineer will be called upon to perform—have their basis in a thorough understanding of costs.

Other administrators who are interested and vitally affected by production costs include the sales manager, concerned with the competitive status of the product, and the financial man with his need for cost estimates in budgeting. Therefore, the engineer to be successful in a small company must be constantly cost-conscious and have thorough training in the field.

Human Relationships: If their critics are to be credited, engineers are hardly outstanding for the smoothness of their personal relations in business. The lament regarding the engineer so often runs: "He is right, of course. But why must he be so overbearing and lordly. We work here too."

Perhaps it is inevitable that this situation should prevail. The engineer spends endless efforts in college, training to work things out to several decimal places. He is taught the virtue of precision. All of this is very worth-while. Production of material goods rests largely on this exact, physical science foundation. But, people do not react like high-carbon steel, and conflicts between the engineer and the nonengineer are all to frequent and far too costly.

The engineer, therefore, should have at least a minimum of "sales" training so that he can sell his ideas and designs to other members of the organization. Securing cooperation from people by having earned collaboration is often a demanding order. Increasingly, American management thinking has shifted to a newer insight into productivity. The engineer's training must include it too, often by in-plant training.

Training Methods: The small firm is poorly adapted to the classroom training methods of the larger company. Neither the number of people involved nor formal training facilities available make such an approach feasible. Rather, what is required is continuous informal, on-the-job instruction by senior company executives, by cooperative decisions, *Fig.* 1 and by conferences between engineers and their collaborators in other functions of the organization.

If informality is the watchword, however, this means no lack of plan. It may frequently be advisable to appoint some company representative to serve at least part time as coordinator for such informal training activities. The following types of training aids might profitably be used in setting his and the company's proper course:

1. Analyzing of job descriptions of all key positions.
2. Making appraisals (phychological and nonpsychological) of all key people.
3. Relating the two to discover areas of weakness where betterment should be possible.
4. Scheduling small conferences on "hot" topics with suitable chairmen and participants, to assist in orienting each executive to the company's over-all strategy and organizational needs.
5. Bringing in occasional outside speakers to spark new developments in management thinking.
6. Providing liaison with such generally available "outside" training as that in MTM and rapid reading.
7. Arranging individual counseling sessions with each key person to help him plan a personalized program for self-improvement in the arts of management.

The engineer in the small organization, treated in some such way as this, should be enabled to see his optimum usefulness more clearly, to perceive his personal shortcomings more readily and to become of increasing worth to his company. The personal sense of increased management insight and responsibility is an added and surely most valuable extra dividend.

Fig. 1. Public speaking course affords engineers an opportunity to learn to think on their feet and feel at ease in addressing groups.

TRAINING ENGINEERS
in a large organization

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To MAINTAIN a large force of engineers requires hiring to balance normal turnover and expansion. Normal upgrading of engineers into supervision and management is also accelerated by any expansion program.

Because of the acute shortage of engineers it has been necessary to hire people who may have deficiencies in formal engineering education, experience or a combination. Further, the newly graduated engineer requires extensive practical training before he is able to make use of his theoretical knowledge. New employees will require, in addition to broad orientation, specific training tailored to the individual, *Fig.* 1. The training should be concentrated so the new man's services are not delayed unnecessarily and so that he is motivated by an awareness that the training will contribute to his future work.

To maintain knowledge in technical work presupposes development of talents. Such development is facilitated both by job rotation and training. Courses are, for the most part, specialized and more sophisticated than courses for new employees. Job rotation programs are invaluable in providing a breadth of experience necessary for engineering classifications of higher responsibility.

There is no sharp line of demarcation in engineering occupations between the supervisory and nonsupervisory skills. Every engineer is expected to be able to direct the technical efforts of less experienced engineers. On the other hand, as an engineer is promoted into the established supervisory positions, he not only takes on greater responsibility for directing the efforts of subordinates in the technical field but he also assumes new responsibilities in the personnel field, *Fig.* 2.

At least 40 percent of the engineers in any large organization are in jobs which necessitate the obtaining of cooperation, coordination and collaboration with other groups both technical and nontechnical such as customer, vendor, planning, account-

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Abstracted from paper 23TC3D, "In-Plant Engineering Training for Large Organizations," presented at the 23rd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

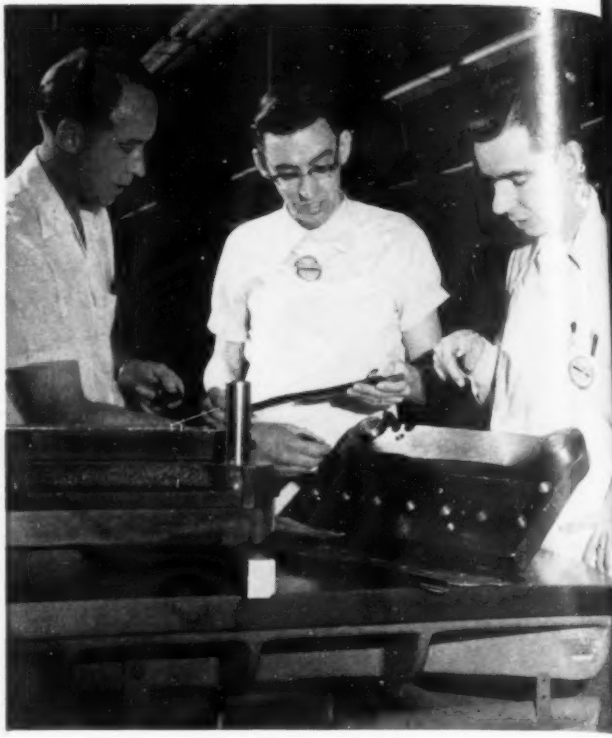

Fig. 2. (above) Engineering production department head checks progress of engineer in his group who is receiving in-plant training.

Fig. 3. (right) Tool design trainees receive instruction from supervisor in tool and die shop while working on a form die.

ing, price estimating and scheduling. To successfully accomplish this requires competence in one of the most important skills of supervision—human relations.

Technical training programs must be open to all engineers regardless of status. The program must include and encourage engineers to study human relations and supervisory skills. Any effort on the part of a company to train employees individually, collectively or in small units, whether or not on company time or property, constitutes in-plant training.

The following types of classes and courses comprise the Lockheed training program. However, it is doubtful if all of these units would be in operation at the same time. They are activated only as needed.

Engineering Indoctrination: This is a flexible program varying from several days to four weeks depending upon the requirements of the job and the background and skill of the individual. The present program consists of eight courses wherein the new employees are instructed in Lockheed drafting practices, the use of company manuals and references. It can be readily expanded to cover other engineering personnel or to qualify new employees of lower skill or abilities.

This type program has several advantages. It gives a new man a chance to get acclimated. It gives him a chance to make a few acquaintances and learn some of the basic company rules, policies and procedures while free from the strain of a job assignment. The program relieves line supervision and also permits some evaluation to be made of the new man by trained placement personnel.

The orientation program fluctuates considerably due to the variable hiring periods. It peaks following graduation. A certain minimum number of full-time instructors are maintained. However, in peak periods, engineering supervisory and staff personnel are drafted to discuss specific fields and jobs.

On-the-Job Training: On-the-job training of an informal type probably constitutes most of the training any employee receives and, what is more important, retains. It has the disadvantage of being limited in scope by the ability of the supervisor and the exigencies of the job.

A formal on-the-job program currently is being used for training a fairly large group of tool designers. It became necessary some time ago to expand the tool design group. Because of lack of trained tool designers, selected individuals were brought up from the tool shops.

These men had educational backgrounds varying from high school through engineering degrees; experience varying from a few years in a specific shop to several years of varied experience in toolmaking. Depending on their individual experience, these men were placed in the tool design areas most suited to their background. They were assigned to senior tool engineers who instruct on the job. Now there are approximately 25 men in the program.

A program wherein beginning engineers are given varying assignments designed to facilitate their

growth and development is of utmost importance to all engineering. Job rotation is being developed in both tool engineering and design departments. In each instance, the rotation program is tailored to individual needs. A tool engineer may spend time in the major jig and fixtures group or press tools, masters, cutting tools, forming tools, *Fig.* 3, etc.

Each person placed on job rotation should be assigned to someone in the area where he will ultimately obtain permanent placement so that person can act as guide and counselor and, if need be, protector of that particular program. Periodically, those trainees should participate in a guided discussion wherein they will learn from the experiences of the others.

Salaries are governed by the prevailing salary group or job classification they are in at the beginning of the program. Reviews for the purpose of performance rating are continued so that the employee loses nothing and stands to gain considerably from the program. There are twelve engineers assigned to this program in the design engineering and two tool engineering graduates.

In a shop experience program, college graduates spend up to one year working in various shop departments as trainees, *Fig.* 4. Salaries are governed by prevailing rates in the parent engineering department and are charged to the parent engineering department budget. The tool engineer would spend most of his time in the toolmaking shops with sufficient time in the manufacturing areas to get a feel for the thinking and desires of the people who work with the tools he designs. This program has proved successful in tool engineering and as a means to develop staff and supervisory reserves.

Company Classes: This training is given during working hours. The subject matter may vary considerably to care for specific needs. Classes have included: a course for nonaircraft engineers to familiarize them with aircraft structures and systems, training of production design engineering in electrical and electronic installations, a special course in shop orientation, *Fig.* 5, a review of new manufacturing techniques and facilities for supervision and executive engineers. All such training is under direct supervision of and paid for by the company.

The company pays only a part of the cost of the following training and has no direct supervision of the individual course content. Neither of these programs has been finalized.

Cooperative Programs: Under the undergraduate program, employees are permitted to work toward an engineering degree by working 5/8 time and carrying at least 1/2 of the regular school programs at a local college. One-half of the tuition costs are paid by the company.

A graduate study program which is also cooperative permits college graduates to work 25 hours a week, receive 5/8 of their regular pay and carry on at least a 1/2 program of study toward a Master's degree.

The company has had a cooperative program in its Marietta Division with Georgia Institute of Technology and a trial setup with M.I.T. at the Burbank Plant. A cooperative program is also being discussed with UCLA. The primary interest of this program to the company is that it trains the student-employee in the fundamentals of the industry. If the student later becomes a full-time employee he naturally can be integrated much quicker.

To encourage engineers to enroll in evening courses at the local universities, 1/2 of their tuition cost is reimbursed upon satisfactory completion of courses pertinent to their work. Over 260 engineers have taken advantage of this program in the fall semester.

Company Evening Courses: In instances where highly specialized courses are required, they are arranged by the company and given in the Training Building or other local facilities. Qualified specialists are engaged to instruct these courses. Attendance is voluntary and no tuition is charged. Typical subjects for such courses have been "Thin Sheet Analysis," "Sheet Metal Production Design," "Basic Loads," "Applied Mathematics," "Stress Analysis for Designers," and so on. Fourteen such courses are being conducted now.

The management development program is company wide. It is generally limited to supervisory and staff personnel. Engineers are trained in supervisory skills in the company of supervisors from other departments. This is of benefit because engineers are by training and education seldom aware of people and problems outside their own technical

Fig. 4. Production engineering trainees at work on production floor, tracing circuit of electrical wire installation.

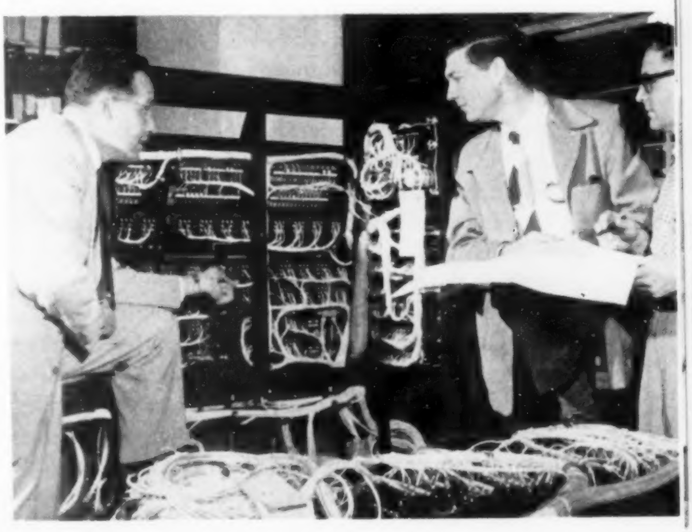

Fig. 5. Producibility, one of basic engineering in-plant courses, elicits lively discussion of methods of economically manufacturing an aircraft component.

sphere. This is a voluntary program. In the past year, 90 enrollments from supervision or staff people in engineering areas alone have been accepted for these classes. Also business administration courses, seminars and lectures offered by universities up to 3 months in length are made available to selected supervisory personnel.

Counseling: Assistance is made available to all engineering personnel in formulating educational plans and determining specific courses to pursue. Line supervision is responsible for counseling and encouraging employees to take advantage of educational opportunities, *Fig.* 2. In addition trained employee counselors are also available.

The keynote of any in-plant training program is flexibility, in the number of people involved, in the number of subjects to be covered, in the frequency of repetition of courses and in meeting individual requirements.

In-plant engineering training in a large organization is big business. It requires the services of experienced personnel. In a well-rounded training program, individual programs must fit a definite need, otherwise company time and effort are wasted. All parts of an in-plant engineering training program must be interrelated. Thus orientation fills the gap between actual working skills already attained and on-the-job training to fit the specific needs of a new job. Tuition reimbursement allows for maintaining knowledge of the state of the art plus accumulating further credits toward a degree. It must also be considered in relation to the graduate and undergraduate programs which are generally aimed at making it possible to complete those courses needed for a degree but which are not available in the night extension system. The night-class program supplies specific specialized material not available through the college programs. Job rotation and shop experience serve to fill gaps in practical knowledge.

Brazing Technique for Porous Metal

PARTS made of porous sintered metal are being brazed faster and more satisfactorily through a method developed by Handy & Harman. In cases where such parts are dense, pieces can be brazed normally. However, when parts are highly porous, such as in bearing applications, the contacting porous parts tend to absorb the brazing alloy into the metal, leaving little alloy on the surface, and preventing a proper joint. To discourage this action, researchers brushed or dipped a colloidal graphite on the porous sintered surfaces, as illustrated. Soaking into the interior of the pieces, the graphite emulsion formed a nonwettable, nonabsorbent coating.

After the piece had dried, the graphite coating was removed from the metal surface either with an emery cloth or a brushing wheel using light contact pressure, and the surface was degreased with a suitable solvent. When the piece was dry, it was fluxed and brazed in the usual manner with immediate satisfactory results.

This method now is being practiced profitably by a number of firms. An additional economy is accomplished, they find, if parts are handled in batches, thus cutting handling time to about a minute a piece.

A coat of collodial graphite brushed on the joint faces of a highly-porous sintered metal part before brazing prevents absorption.

more efficient machining

may result from temperature research

By Victor Paschkis

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WITH FEW EXCEPTIONS, determination of temperature distribution during cutting operations has been limited to obtaining an average value. It is hoped that a special analog computer will be the tool for finding actual distributions so they can be analyzed. Tool life, for example, probably depends on maximum temperatures rather than on averages. Also, stresses induced in workpieces depend on gradients rather than on average temperatures.

Because of the difficulty of direct measurement of temperature distribution, the ASTE Research Fund Committee has jointly undertaken with Columbia University the project of determining if distributions can be computed accurately. The project consists of computing the temperature distribution during a simple cutting operation and then attempting to physically measure the temperatures. This research paper concerns the computation phase of the project.

One of the most valuable assets resulting from the study of temperature effects by electrical analogs is the fact that rapid temperature changes can be slowed for accurate observation. This technique has proved reliable in previous temperature studies.

Cutting conditions have been purposely simplified so that physical verification will be easier. If the technique is proved, temperature distributions can be computed for more realistic cutting conditions where verification would be impractical, if not impossible.

The system that was investigated comprised a heat source moving at a cutting speed of 25 fpm over the surface of an SAE 1040 workpiece. Heat source (tool) and workpiece widths are assumed equal. Further simplifications include the following points: a single cut is made; heat losses from the sides of the workpiece are disregarded; 50 percent of heat generated is projected onto the workpiece surface; friction between tool and chip, and between tool and workpiece is disregarded, and workpiece end effects are disregarded. The shear angle is assumed to be 30 deg, the depth of cut is 0.002 inch and heat source width is 0.005 inch.

All temperatures have been expressed in percentages of the maximum, and the maximum occurs within the span of the heat source. Temperature distribution was plotted as isotherms (lines connecting points of equal temperature). Such charts graphically relate temperatures of points at any depth below the workpiece surface and any distance from the heat source.

Time-temperature curves can be developed from such charts. For a typical point, 0.001 inch below the cut surface, temperature rises appreciably only shortly before the heat source is directly over it. Time to reach its maximum temperature is about 0.002 sec after the rapid increase starts. Temperature reduction at this particular point is stretched over a much longer period of time. The temperature reduces not to the initial value, but to the new mean temperature of the workpiece, which is higher.

If multiple cuts are taken, similar increases in temperature will occur from gradually increasing starting temperatures until such time as the heat input per cut equals the heat losses. Then, each cut introduces an equal time-temperature cycle.

Until the method is proved as a research tool, the important indication of this project has been that heat has surprisingly limited penetration into a workpiece. Considering a single cut, the temperature increase of a point 0.01 inch below the cut surface does not quite reach 20 percent of the maximum increase within the heat source.

Abstracted from a research report, "Temperature Distribution in the Workpiece," presented at the 23rd ASTE Annual Meeting. Copies of the research report, as presented, are available from Society Headquarters.

frozen-mercury process

increases scope of investment casting

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Abstracted from paper 23T11, "Investment Castings by the Frozen Mercury Process," presented at the 23rd ASTE Annual Meeting. Copies of the complete paper are available from Society Headquarters.

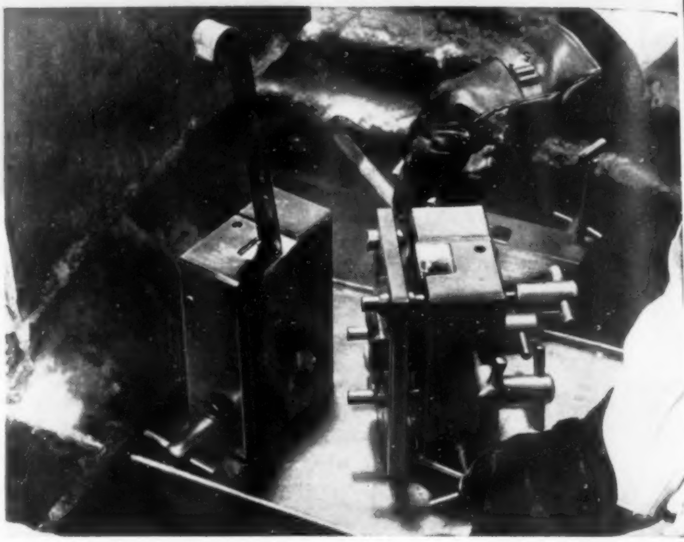


Fig. 1. Frozen mercury pattern in booking die prior to welding of two sections.

ADVANTAGES of frozen mercury as a pattern material stem from two fundamental physical properties of mercury: the low volumetric change on melting and the high rate of self-diffusion which allows mercury to be self-welding. The small volume change which occurs during melting permits manufacture of parts of large size and permits the use of a thin shell mold which is an advantage in itself. The self-welding property permits making complex shapes because molds can be easily booked.

The volume change which occurs during melting is important because of the stresses which are imparted to the mold walls during the removal of the pattern. With a wax or plastic pattern the volumetric expansion is about 9 percent or a linear change of 3 percent. Thus when wax is removed from a mold by melting, a strain of 0.03 inch per inch is imposed on the mold walls.

This strain is sufficient to cause the mold walls to rupture unless they are heavy. The amount of strain which mold walls can withstand limits the size of castings.

On the other hand, mercury has a volumetric expansion on melting of 3.5 percent or a linear change of 1.8 percent. In removing the frozen mercury from the mold, strains imparted to the mold walls are low. Because of this, large investment castings can be made. Also, a thin shell mold can be successfully utilized.

Making the Pattern: In principle, the frozen-mercury process is simple. Liquid mercury is poured into a steel die and frozen in a dry ice-acetone bath at −100 F. During the freezing period, the die is progressively lowered into the bath to control the solidification so that the surface is free from shrinkage defects. The surface of the frozen mercury pattern is smooth, clean and free from imperfections. Because of the high density of mercury and the general properties inherent in a liquid, no difficulties are encountered in filling thin sections or those which vary greatly.

When two pieces of frozen mercury are brought together, they may be firmly welded by the application of a light pressure. This property facilitates construction of patterns with complex internal passages and undercuts.

To make a pattern which requires booking, a die with a match plate is used, *Fig*. 1. The match plate containing the core details is placed between the two die halves. Mercury is poured into the two die cavities and frozen, after which the match plate is

removed. The two frozen mercury portions are brought into intimate contact to accomplish the booking operation. In joining the mercury patterns, alignment of the die is maintained by precision die dowels. Other accessory guide devices may also be used. This method permits registry to within toolmaking accuracy. Of importance is the fact that in the direction perpendicular to the parting line no change of dimensions is encountered.

Producing the Shell Mold: Unlike other investment-casting methods, the frozen-mercury process employs a thin shell mold into which the molten metal is cast. After the mercury pattern is made, the ceramic shell mold is built up by dipping into a slurry at —80 F. The shell mold is made by successively dipping the pattern into slurries of increasing viscosity until a thickness of about 1/8 inch or more is reached.

The first slurry is thin and contains refractory particles of small size. This coating imparts an excellent surface finish to the final casting. The vehicle used is volatile at the temperatures employed in the dipping process so that the drying time is only a few minutes on the first coating. As the viscosity of the coatings increases, the drying time lengthens.

After the shell mold has been built up, the mercury is extracted. This is accomplished by introducing mercury at room temperature into the sprue or gate. After most of the mercury has been washed from the heavy sections, the mold is allowed to come to room temperature and the remaining mercury is poured out. The recovery of mercury is practically complete.

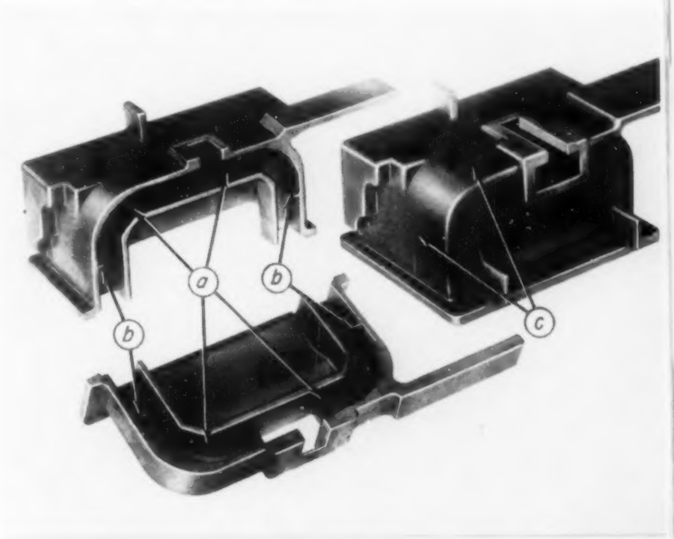
After the mercury is removed from the green molds, they are given a baking treatment to insure complete removal of the solvent. The molds are then placed in a furnace and held at 1850 F for two hours. Preheating procedures are unnecessary. After molds are cooled to room temperature they may be stored for indefinite periods of time.

The ceramic shell mold is fairly permeable so suction casting techniques can be used to cast sections of extremely thin cross-sections without resorting to preheating of the mold. For this process, the mold is packed in a flask by means of a loose material such as shot or coarse sand. A tight cover in the form of a layer of ceramic cement is placed on the top.

The flask, which has a false bottom, is placed on wet asbestos paper on a flat table. Bottom edges of the flask are pressed against the wet asbestos paper to form a tight seal. Suction is applied at the bottom of the flask through a pipe which leads to an evacuated chamber. With this process uniform filling takes place.

In many cases, with lost wax or plastic investment casting, it is difficult and expensive to remove cores. They often become vitrified by the heat of the molten metal poured into the mold, and extraction of the cores through small openings becomes almost impossible. In the frozen mercury process, thin cores are broken up easily by rapping the gate or sprue, to which the casting is attached, with a pneumatic hammer. The fragments are shaken out.

Fig. 2. Bronze wave guide investment cast by frozen-mercury process. Cross-sectioned part at left shows fineness of internal detail secured.



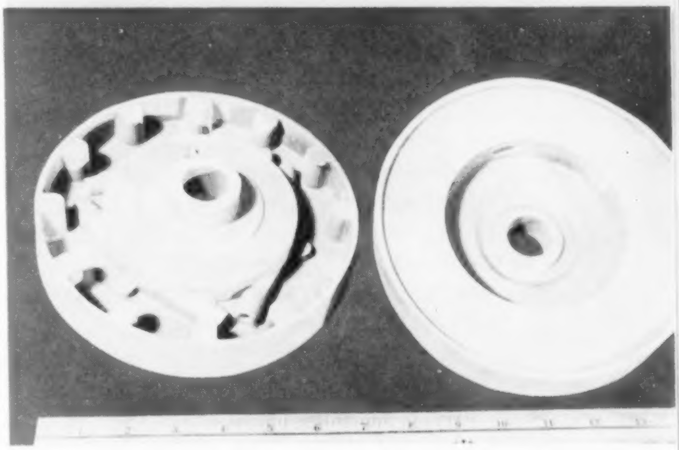


Fig. 3. Aluminum alloy aircraft fuel pump, with integrally cast jets. Overall size is seven inches; section thickness varies from 0.125 to 0.450 inch.

Applications of the Process: The large number of parts made today by the frozen mercury process demonstrates its versatility for producing large and complex castings.

One such part is a wave guide, *Fig.* 2, being made by the Alloy Precision Casting Co., Cleveland. This particular wave guide is for airborne electronic equipment. The part serves as a structural unit as well as a wave guide. As a wave guide, the interior surfaces (*a*) must be completely

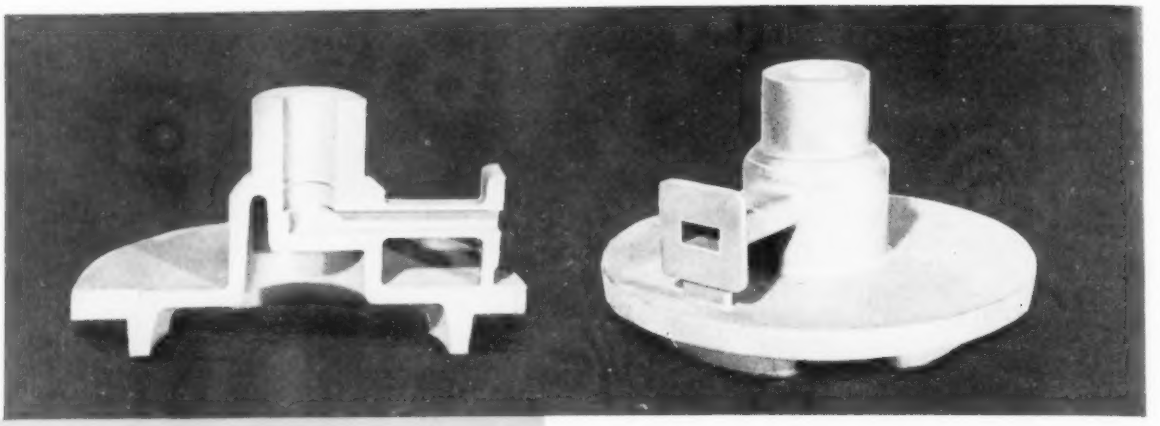


Fig. 4. (above) Air-borne radar part sectioned at left to show complexity of internal detail. Strength secured is sufficient that the cast unit serves a structural purpose as well as functioning as a wave guide.

Fig. 5. (left) Heat diffuser investment cast of Hastelloy B requiring uniformly spaced, smooth and accurately contoured vanes. Part is similar to centrifugal pump rotor but requires high corrosion resistance.

free of all defects and have a 63-micro inch, rms. finish. The "iris" section (*b*) must be sharp and free of edge roughness. This wave guide which is cast in 88-8-0-4 bronze weighs 1⅜ pounds. The interior core (*a*) required a booking operation, performed along line (*c*).

The invested part shown in *Fig.* 3 is an excellent example of how economies are achieved by using the frozen mercury process for casting. The aluminum alloy part is an aircraft fuel pump which might be produced by various techniques. The over-all size is seven inches and section thickness varies from 0.125 to 0.450 inch. However, this part contains three pairs of venturi curved fluid metering jets located 120 degrees apart around the housing. To produce these venturis with uniformly smooth curves by machining would prove costly. Matched, highly accurate steel cores which could be accurately located in the steel die were used in the casting.

When parts can be combined, large savings are achieved both in initial cost and in assembly time. There are instances where as many as 25 assembly operations were eliminated by a suitably designed casting. While in some of these the cost of the casting itself was high, the time saved in the assembly operation and the reduction in the number of parts resulted in a large saving. Design advantages were achieved by the compact end item.

An example of this type of assembly is found in airborne radar. Units must be as light and as compact as possible. Any saving of space or weight is accompanied by an increase in pay load for the aircraft. The radar part shown in *Fig.* 4 has a rather complex internal core which must be accurately held to within ± 0.003 inch. The part is made to serve both as a structural part and as a wave guide. The upper part of this casting serves as a fitting for the rotating part of the antenna system. Prior to the manufacture of this part by the frozen-mercury method, the part was made by electroforming. The internal core is too complex for machining or even economical production by the lost wax process. When made by electroforming, the part was structurally weak.

Alloys which withstand high stresses and have good oxidation resistance are difficult to machine and weld, but may be produced by investment casting. The heat diffuser shown in *Fig.* 5 is made from Hastelloy B, a metal chosen to fulfill design requirements. Its ten-inch diameter placed the part outside the normal realm of the lost-wax technique and the requirement for surface smoothness of 60 micro-inches, rms, prohibited the use of sand casting.

Maximum benefits which can be derived from the use of the frozen-mercury process start at the design stage. Usually at this time, the designer will have in mind some method for production of the part. The design is thus limited by the designer's knowledge of processing methods and limitations in the processes themselves. By its ability to make complex shapes, the frozen-mercury method will afford the designer much greater freedom to design parts from a completely functional point of view, unhampered by manufacturing problems.

projection welding

. . . growing importance for automatic assembly

By Ralph H. Eshelman
Associate Editor

BECAUSE AUTOMATION of machining and forming processes has outstripped assembly methods, more and more emphasis is being focused upon development of better assembly operations. For this reason the last few years have witnessed a remarkable growth in resistance welding in the leading metal fabricating industries, such as automotive, aircraft and electrical appliances. Of all resistance welding methods, probably the least known but most advantageous for this purpose is projection welding. This process certainly deserves greater attention by designers, process planners and tool engineers generally than it has received.

Projection welding, in essence, is a refinement of spot welding in which an upper platen or die presses the parts to be joined against a lower die. Raised projections on one or both of the parts localizes the heat, causing fusion of the two parts in the areas of the projections quite similar to spot welding. After proper projection welding, the parts joined are in close contact, as in spot welding. The basic differences between spot welding and projection welding are that the points to be welded are located exactly by the projections previous to the operation and that multiple spots can be produced by the relatively large electrodes used. Generally speaking, however, the power requirements are higher for projection welding than for spot welding.

This method affords longer life to the electrodes since they can be of harder alloys and there is less wear and maintenance resulting from fusing, overheating and burning. Prelocating of the weld spots is also an outstanding advantage, permitting welds

Fig. 1. Automatic dial index feed and simple fixtures in projection-welding setup at Buick Div. of GM provide high rate of assembly of rod and cup details for valve operating mechanism. Only loading and unloading are manual.

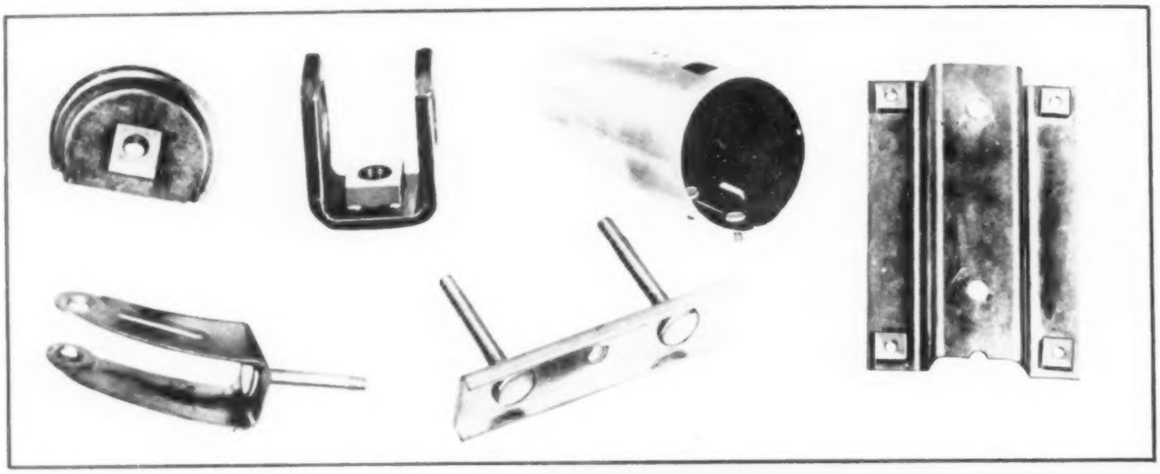


Fig. 2. (above) Typical application of projection-welded fasteners. The joint produced is often stronger than the body of the screw and is virtually free of distortion or discoloration.

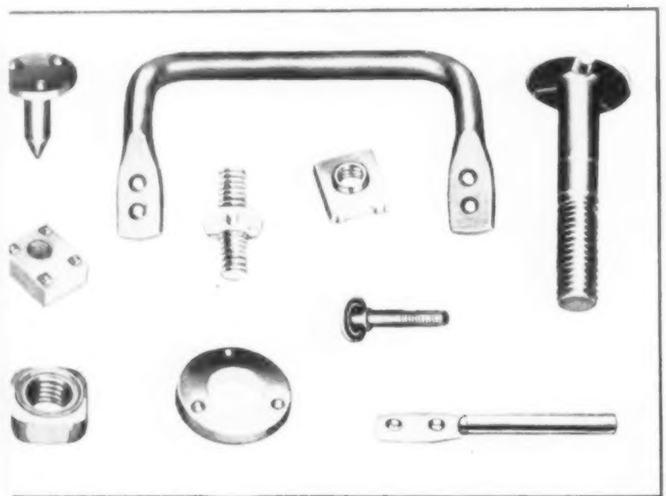


Fig. 3. (left) Special parts for projection welding indicate scope of applications. Nut and bolt with annular ring projections are for liquid-tight seals or curved surfaces.

—Photos courtesy The Ohio Nut & Bolt Co.

that would be impractical by other resistance methods. Thus a larger number of welds can be concentrated in a given area than is generally possible in spot welding.

Projection welding also possesses the advantage of other resistance welding methods over other well-known assembly and joining methods such as: bolting, riveting, stapling, clamping, crimping, soldering, brazing, gas and arc welding, etc. The advantages are: less operator skill, higher production rates, minimal distortion, reduction in number of operations or steps resulting in less tooling, reduced equipment and space requirements, greater product uniformity and material savings.

In addition to these, projection welding sometimes is given consideration over other methods because of the possibility of producing joints with unmarked outer surfaces suitable for parts to be finished by painting, plating, etc. Through a combination of these factors, projection welding frequently offers an economic advantage also, especially where the process can easily be made automatic or semiautomatic, *Fig.* 1.

Although projection welding provides cost and numerous other advantages in appropriate applications, there are limitations to its use. One of these is the fact that only a comparatively small group of metals and alloys can, or at least has, been successfully welded. The list includes:

- Low carbon steels
- Highcarbon and low alloy steels
- Stainless and high alloy steels
- Zinc die castings
- Terne plate
- Some dissimilar and refractory metals

Brass, red brasses and copper have not been welded successfully, though steel has been welded to Monel, brass and aluminum. Aluminum applications are rather rare, although they have been practical in special cases, such as on extruded parts, through careful control. For instance, one well-known utensil manufacturer uses the process to fasten handle lugs to heavy-gage pressure pans. Again, an instrument maker has developed a successful application to fasten a faceplate to an instrument frame to form a hermetically sealed unit, with a considerable saving over the previous assembly method. In this application the surface oxide that forms on aluminum was removed by

chemical cleaning to lower resistance and secure uniformity. A pyramid shaped projection, maintained to close tolerance, and special electrodes were other factors contributing to the success of this operation.

Applications

One of the most common applications of projection welding is for attaching small fasteners, nuts, special bolts, studs, bosses and similar parts to larger components, *Fig.* 2. Such operations can frequently be automatized by dial, hopper or slide feeds, or special fixtures. A wide variety of these small parts are available with preformed projections, *Fig.* 3, making a simplified and low cost method of fastening for small and medium production shops, as well as for mass production industries.

Projection welding of fasteners has gained widespread usage in the metalworking industry because of its advantages for permanently attaching a fastener so that it does not need to be held in position and will not turn when the mating part is put in place. This type of fastener is particularly well adapted to use in blind assemblies, places where the fastener must be integral with the assembly to prevent vibration loosening and inaccessible locations where the fastener must be attached at early stages of fabrication. Development of electronically controlled welders has facilitated such applications because of the ability to control carefully the heat, time and pressure for welding these small parts.

While these are typical applications they by no means exhaust the capabilities of the process. Probably such uses are more widely known and specified because standard welding equipment and simple tooling can be employed, whereas considerable development work and special installations often are required for larger scale operations. Many big companies, especially in the automotive field, maintain welding development departments, but equipment manufacturers provide similar services to organizations that do not have such departments and undertake to advise if specific applications are practical.

Representative of such studies is one made at Ford Motor Co. to determine if projection welding could be used to simplify assembly of the brake pedal bumper bracket to the brake pedal, *Fig.* 4. Previous construction consisted of staking a hub to both pedal and bracket with two additional arc welds between bracket and pedal. The hub was knurled to hold it in the pedal while the bracket had three 1/8-inch radius slots, which were filled in the staking operation to prevent rotation. The weld was added to augment the staked joint in preventing the bracket from turning. This method of fastening was slow and costly.

At first an attempt was made to use four welds equally spaced around the hub. It was found, however, that because shearing of the pedal blank from bar stock bent material down on one side, satisfactory welds could not be secured on that side due to space limitations. In the experimental setup, two projections were then tried and found to be adequate, giving a shear strength of 3800 lb. This was considered to be a better solution than the proposed four welds as tooling cost was reduced due to the lower force requirements and reduced KVA demand for the welding machine.

This application was accepted by both design and manufacturing engineering because it could be readily tooled for high production schedules with components already standard with the company. In

—Photo courtesy Ford Motor Co.

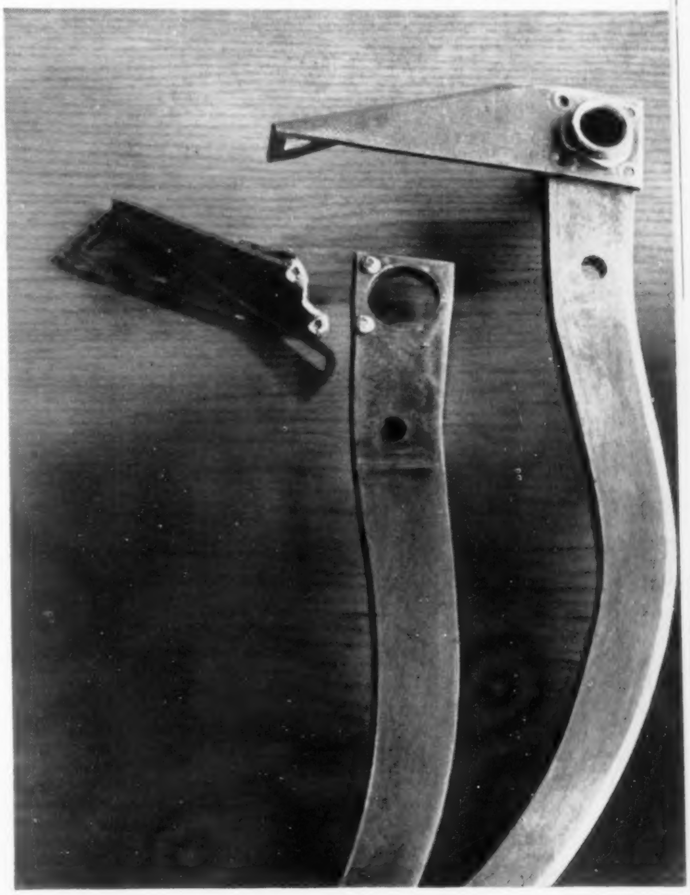
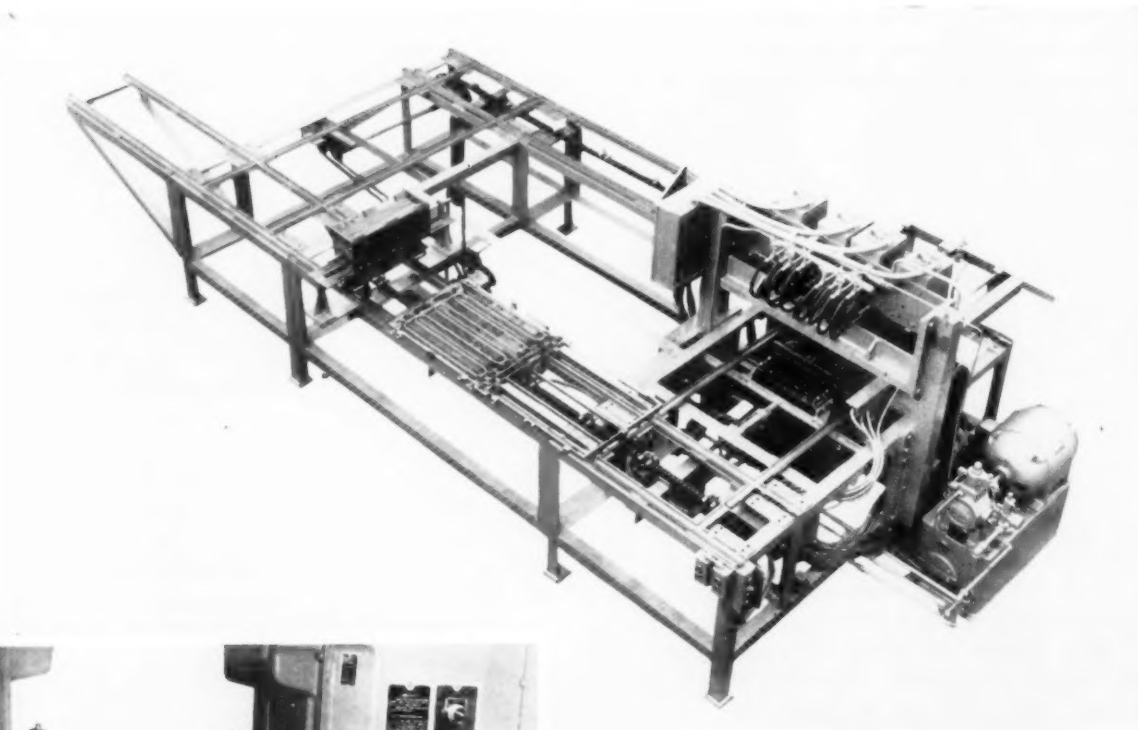
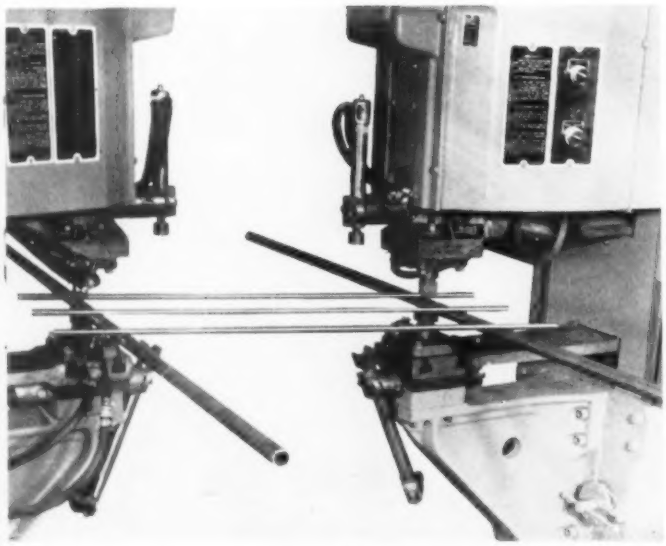


Fig. 4. Test samples of projection-welded brake pedal assembly. Although four projections were formed in bracket only two were needed. Shear strength of 3800 lb is considerably above actual requirements.



—Photo courtesy Taylor-Winfield Corp.



—Photo courtesy Taylor-Winfield Corp.

Fig. 5. (left) Special setup at Production Plating Works, Inc., Lebanon, O., uses standard welders, movable on a common base, to produce wide variety of ornamental ironwork. Electrodes are shaped to fit tubing.

Fig. 6. (above) Special semiautomatic installation for projection welding refrigerator condensers. Parts are unloaded and partially loaded manually. Curvature of tubing and wire localizes heat, eliminating need for formed projections.

addition, replacement of arc welds with projection welds improved design appearance of the pedal and the job could be performed at substantial cost savings. The development report indicated further cost savings as a result of use of welds to prevent rotation of the bracket instead of the staking operation previously used for this purpose.

Thus the punch that blanks the hole in the bracket could be simplified by removal of the radius slots, reducing cost of both the punch and the hammer for the staking operation. Since the projection welds would be made before assembly and staking of the bushing and the pedal, it should be possible to combine the two operations into one.

A special adaptation of projection welding that has wide acceptance is cross-wire welding. In this type of application the diameter of wire or tubing serves to localize weld heat in the same manner as a projection, *Fig.* 5. Assembly of ornamental ironwork, chrome tubing furniture, wire shelves, grills, dish-drying drains and similar household items and components for refrigerator condensers are other examples of this method. A special installation, *Fig.* 6, was designed for the latter operation which assures a high production rate. The machine is of horizontal design with a welding table and track with a jig in which the parts are assembled before welding. An automatic hopper feeds sized lengths of wire into the jig at the rate of 82 wires in 8 seconds. When the wire holders of the jig are loaded the operator places the copper-coated steel tubing serpentine on the bottom wires and folds

over the top layer of wires. As the loaded jig moves into the welder, an indexing mechanism takes over. The welds are made in a four-shot sequence because of power supply limitations. The welder has 8 transformers; 4 above and 4 below the electrodes. Approximately 80 assemblies are finished per hour, depending on size of the condenser.

Other types of operations where projection welding has proved worthwhile include fastening of handles to hand tools, assembly of pressed-metal toy wheels and other toy parts, assembly of mounting brackets, clips, hinges and other hardware to sheet metal parts, *Fig.* 7, assembly of sheet metal radio components, etc. Unless production requirements are unusually high, simple tooling can be used on many such jobs along with standard projection welders. On the other hand, the cost differential favoring projection welding in such applications is frequently so great as to indicate its use despite the necessity for special equipment.

One such example is found in the manufacture of washing machines. The special welder shown in *Fig.* 8, projection welds four mounting brackets to the tub body, using four projections on each bracket. Two sets of welds are made simultaneously. In this setup two air-operated slides furnish welding pressure of 4000 lb. The locating and backup pressure is furnished by four air-operated inner dies. Both inner and outer dies are water cooled. Welds are made in series and a 250-kva transformer supplies the welding current.

The fact that projection welding permits the union of dissimilar metals and materials of different thicknesses greatly widens its scope. While projections for joining sheet metal parts follow definite requirements, suitable projections can also be formed in forgings, plate, tubes and rods. Taking advantage of such possibilities, tool engineers of imagination have in many instances created unusual cost saving processes utilizing projection welding, where ordinarily resistance welding would scarcely be considered.

One such possibility makes use of the end of a rod, chamfered to localize the heat, *Fig.* 9. Only a simple fixture is used to hold the brake pedal and brake pedal arm during the weld sequence. High production is secured in this operation, though both loading and unloading are manual. The welding equipment is standard with dies designed specifically for these parts. In another high-production job, projection welding is combined with a secondary press operation, *Fig.* 10. The welding function is rather conventional, consisting of fastening two reinforcement plates to each end of a frame side rail. In this installation the welders at each end of the press are synchronized to operate with the press. Precision switches prevent actuation unless parts are properly located.

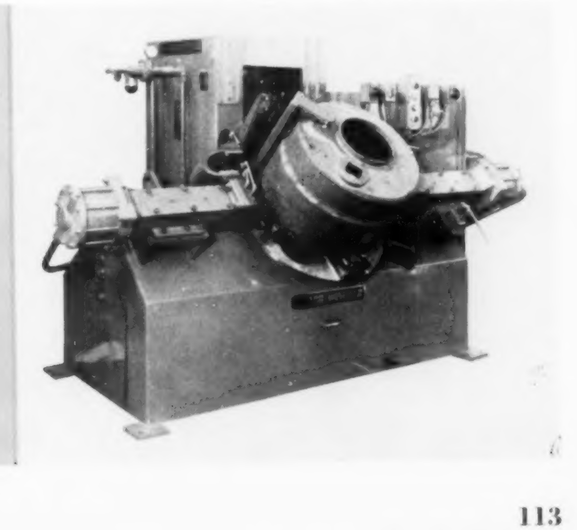
Ring projection welding offers another fruitful field for exploration with a considerable potential for savings in manufacturing costs. One such development, which is typical, is for assembling a drain plug boss in a rear axle housing assembly. Previously a tapped hole had been provided but a design change was requested of manufacturing because leaks developed in service. The welding setup designed for this operation is shown in *Fig.* 11 and the finished assembly in *Fig.* 12. This design has

Fig. 7. Ammunition carrier box with two handle clips, two hinge and lock clips projection welded on cover, other hardware on body. Main joints are seam welded. Production is above 500 units per hour.

—Photo courtesy Taylor-Winfield Corp.

Fig. 8. Special projection welder automatizes washing machine fabrication. Two sets of brackets are welded in series. A foot pedal release indexes table after first set of brackets is joined.

—Photo courtesy Taylor-Winfield Corp.



proved satisfactory from both a service and a production viewpoint.

These case histories are cited to illustrate some of the possibilities of the projection welding process, but are far from exhaustive. They do underscore, however, the advantage of early consultation between product engineering and process engineering departments. While considerable savings can frequently be effected by the redesign of an assembly to utilize projection welding, usually an even greater production economy can be secured if the parts are specifically designed for the process.

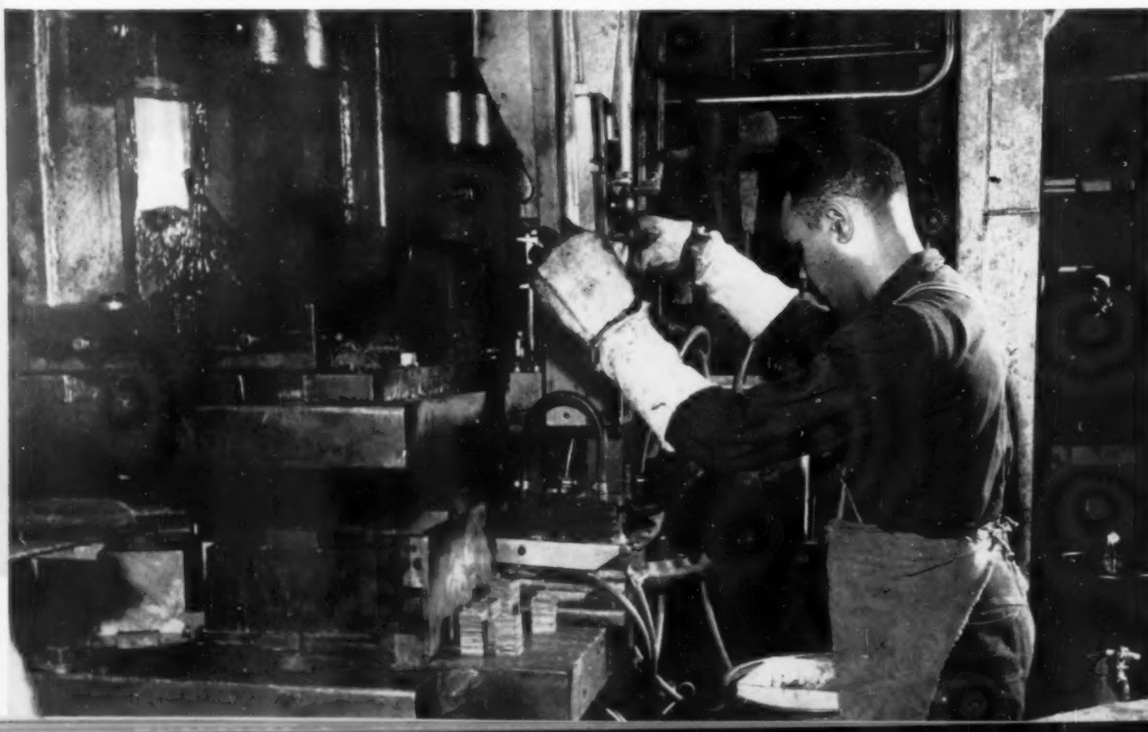
Design of Parts

For parts to be successfully joined by projection welding, the projections must be strong enough to stand up until the metal is heated to the plastic state. This is one of the factors limiting the metals which can be welded, though some exceptions have been noted. Obviously then, the shape and size of projections are of utmost importance in securing satisfactory results. Nevertheless a wide variety of projections has been developed, which are producing excellent results for the applications for which they were designed.

Although individual conditions and requirements vary greatly, standards established by the American Welding Society (AWS) may be considered a general guide or starting point. The design data given, TABLE 1, are for button type projections. In addition, cone type projections are recommended by some authorities for gages heavier than 12. The AWS dimensions are for a projection of maximum size that will withstand recommended electrode forces and will be equivalent to a satisfactory spotweld in diameter, penetration and soundness. While the data in the table represent single projections,

Fig. 9. (left) Ingenious low-cost tooling simplifies assembly of brake shank to pedal at Buick Div. of GM. Remarkable cost savings are achieved in this projection welding application over other possible fabrication methods.

Fig. 10 (below) Bumper reinforcement plates, 0.104 inch thick, are projection welded on each end of a frame side rail of same thickness. This is done during cam piercing and forming of inner rail stops in a gap press at Ford Motor Co. Four projections 0.250 x 0.050 inch are used.



they can be applied to multiple welds by taking into account the three basic factors of heat, time and pressure. The welding current and electrode force are multiplied by the number of projections. The welding time remains the same. The electrodes must be large enough to cover all the projections.

The values in the table are for low carbon steel (SAE 1010), and stainless types 309, 310, 316, 317, 321, 347 and 349, which are nonhardenable and contain a maximum of 0.15 percent carbon.

The minimum shear strengths are taken after the welding machine has been set up and exclude test welds taken during adjustment. Some variations in weld strengths are unavoidable, regardless of how closely welding variables are regulated. For this reason production settings should be held above the figures that will produce a minimum weld. Settings to give a weld 20 percent stronger than the minimum are sufficient to prevent any welds from falling below the minimum. The exact amount, however, can be determined more closely after experience with an operation.

Figures given under "Minimum Shear Strengths", TABLE 1, are for steels of three different ranges of tensile strength. The first column for "Tensile Strength below 70,000 psi" is for low-carbon steel. The second column in "Tensile Strength 70,000 to 150,000 psi" is for low-carbon steels and stainless steel fully annealed or quarter hard. The third column, "Tensile Strength 150,000 psi and above," applies to stainless steels from one-half to full hardness.

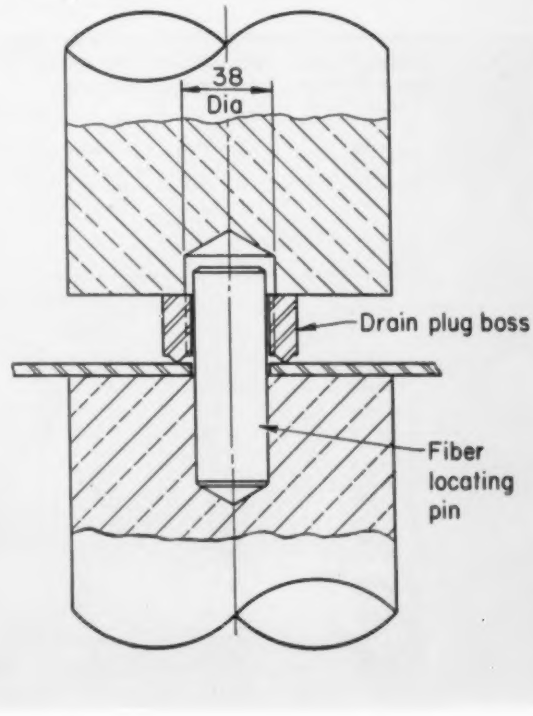
The diameter of fused zone is helpful as a comparison in checking size, penetration and soundness of welds by etch tests. Where materials of different thicknesses are used the size of the projection is normally determined by the thinner piece. However, the projections should ordinarily be on the thicker piece. This is so that these higher resistance points will not be burned off before the flat welding surface is raised to fusion temperature.

Standard AWS spacings for projections are indicated in *Fig.* 13, for use in conjunction with the dimensions given in the table. As shown in the figure, the weld should be in the center of the overlap. Where one of the parts is flanged the overlap dimension should not include any of the radius of the flange. The spacing for multiple welds should be no less than twice the diameter of the projection. Attempts to make closer welds may result in material distortion or weld expulsion. Projections for multiple welds must be of the same height to secure simultaneous contact with the electrodes. For this reason three projections are used where possible in parts such as shown in *Fig.* 3. In general, for height of projection, a tolerance of ± 0.002 inch is allowable in material to 0.050 inch, and 0.005 inch in material over that thickness.

Projections in sheet metal are commonly embossed by a stamping operation, and punch and die design data are readily available. Satisfactory projections are also formed by forging, coining or heading, *Fig.* 3, in blanking or other preliminary forming or machining operations. Regardless of the method of forming, even partially severed or deformed projections should be avoided as they will produce inferior welds.

The circular shape is theoretically preferable because it gives a uniform growth to the weld from the center outwards. In practice projections are frequently made in a variety of other shapes to suit the application. For instance, an elongated form is used in joining parts to curved surfaces; annular beveled surfaces are used for leakproof fittings, *Fig.* 12. A beveled rod end has proved satisfactory. In tubular and wire parts of small diameters, the surface curvature serves as the projection. A part having a thin edge, which is

Fig. 11. Special electrodes and insulated pin used for positive location of drain plug in projection welding it to differential cover at Ford Motor Co. Electrode force is 1000 lb and secondary current is 18,000 amps. Phase shift control is used for close adjustment.



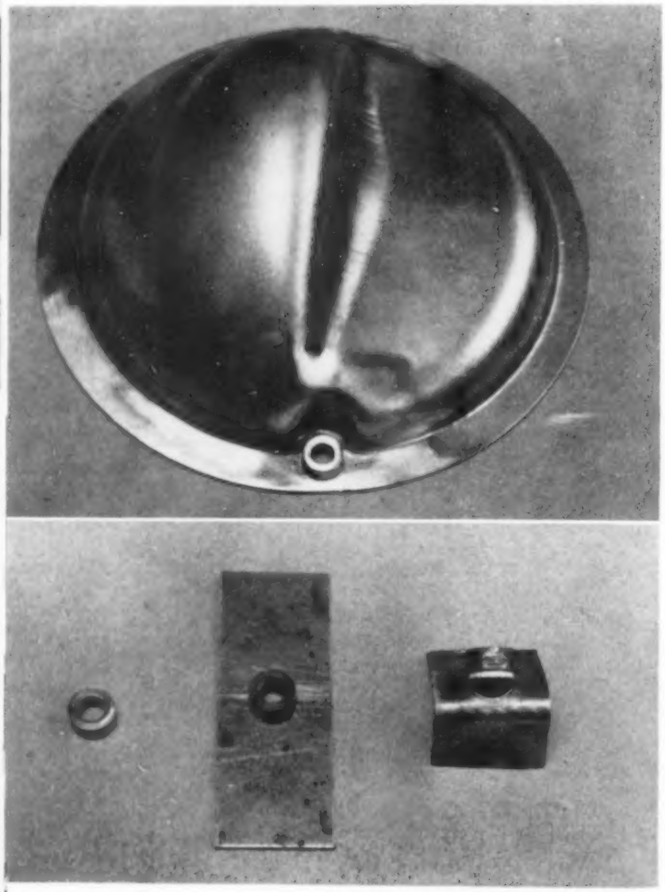


Fig. 12. Differential cover assembly produced from setup in Fig. 11. (Bottom) projection is annular ring on boss which completely seals joint. Tests proved developed weld to be stronger than cover material.

sometimes sawtoothed, also provides sufficient heat concentration, as illustrated in some of the applications previously cited.

Process Considerations

When dissimilar metals are welded the projection should be placed in the piece of higher conductivity. The best welds are secured when the metal surfaces to be joined are in bright condition. The surfaces should at least be clean and free of scale, oxides, paint, grease and oil. Commercial finishes such as phosphate coatings, which are poor conductors of electricity, should be applied only after welding. Hot-rolled steel or annealed parts should be pickled before welding to remove scale or oxides. While platings should preferably be applied after welding, often an assembly may be too large or complex. Though some platings create difficulties, zinc, cadmium and nickel interpose no serious problems. The weld time should be held as short as possible to minimize discoloration. Ternplate, tinplate and galvanized steel are also readily weldable.

Recommendations of the AWS on values for

Table 1—Design Data for Projections

Nominal Thickness of Thinnest Outside Piece (inch)	Diameter of Projection (inch)	Height of Projection (inch)	Minimum Shear Strength (Single Projections Only): Tensile Strength Below 70,000 psi (lb)	Tensile Strength 70,000 up to 150,000 psi (lb)	Tensile Strength 150,000 psi and above (lb)	Minimum Diameter of Fused Zone (inch)	Minimum Contacting Overlap (inch)	Nominal Thickness of Thinnest Outside Piece (inch)
0.010	0.055	0.015	130	180	250	0.112	1/8	0.010
0.012	0.055	0.015	170	220	330	0.112	1/8	0.012
0.014	0.055	0.015	200	280	380	0.112	1/8	0.014
0.016	0.067	0.017	240	330	450	0.112	5/32	0.016
0.021	0.067	0.017	320	440	600	0.140	5/32	0.021
0.025	0.081	0.020	450	600	820	0.140	3/16	0.025
0.031	0.094	0.022	635	850	1100	0.169	7/32	0.031
0.034	0.094	0.022	790	1000	1300	0.169	7/32	0.034
0.044	0.119	0.028	920	1300	2000	0.169	9/32	0.044
0.050	0.119	0.028	1350	1700	2400	0.225	9/32	0.050
0.062	0.156	0.035	1950	2250	3400	0.225	3/8	0.062
0.070	0.156	0.035	2300	2800	4200	0.281	3/8	0.070
0.078	0.187	0.041	2700	3200	4800	0.281	7/16	0.078
0.094	0.218	0.048	3450	4000	6100	0.281	1/2	0.094
0.109	0.250	0.054	4150	5000	7000	0.338	5/8	0.109
0.125	0.281	0.060	4800	5700	8000	0.338	11/16	0.125
0.140	0.312	0.066	6000	—	—	7/16	3/4	0.140
0.156	0.343	0.072	7500	—	—	1/2	13/16	0.156
0.171	0.375	0.078	8500	—	—	9/16	7/8	0.171
0.187	0.406	0.085	10,000	—	—	9/16	15/16	0.187
0.203	0.437	0.091	12,000	—	—	5/8	1	0.203
0.250	0.531	0.110	15,000	—	—	11/16	1 1/4	0.250

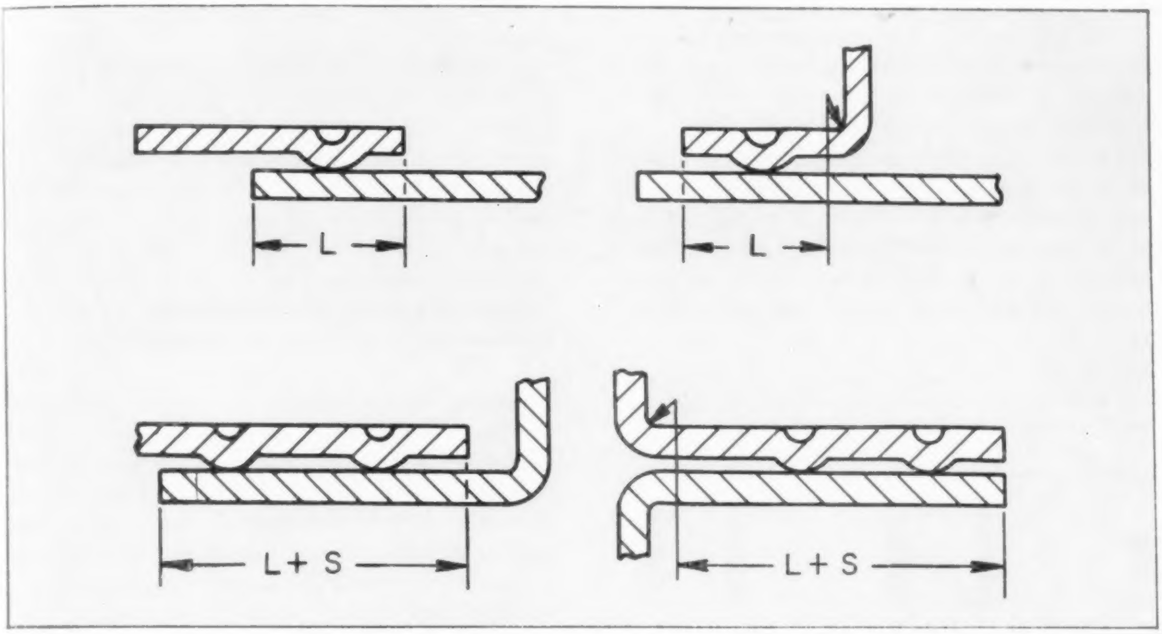


Fig. 13. Minimum spacings (S) recommended for different weld conditions. *Table* 1, are twice the projection diameter. For multiple projections overlap is equal to actual spacing between projections plus overlap (L) required for a single-projection joint.

variables in the process are given in TABLES 2 and 3. They are based on a flat-faced type of electrode with sides beveled 20 deg. While the tabulated sizes of the electrodes are minimum, larger sizes, within reason, show no appreciable effect, as long as proper water cooling is maintained. The welding current (secondary amperage) is an approximate value intended to produce welds of shear strengths 20 percent above those recommended in TABLE 1.

Welding time is designated in cycles, based on 60 cycles per second. Weld time should ordinarily be as short as possible. The weld is made in one hit. Hold time, the period during which the electrodes are held against the work after current flow has stopped, should be sufficient so the material is below visible red heat when the electrode leaves the surface. This greatly reduces oxidation.

Because of the range of possibilities of the projection welding process, shapes and sizes of electrodes vary widely in actual applications, such as those illustrated. Fortunately, a wide variety of work can be handled with standard welding equipment by use of special electrodes. A number of different setups

Table 2—Projection Welding Process Data for Low-Carbon Steel

Nominal Thickness of Thinnest Outside Piece (inch)	Minimum Electrode Face Diameter (min.) (inch)	Net Electrode Force (lb)	Weld Time (cycles)*	Hold Time (cycles)*	Secondary Welding Current (amps)	Nominal Thickness of Thinnest Outside Piece (inch)
0.014	⅛	175	7	15	5000	0.014
0.021	3/32	300	10	15	6000	0.021
0.031	3/16	400	15	15	7000	0.031
0.044	¼	400	20	15	7000	0.044
0.062	5/16	700	25	15	9500	0.062
0.078	⅜	1200	30	30	13,000	0.078
0.094	7/16	1200	30	30	14,500	0.094
0.109	½	1700	30	45	16,000	0.109
0.125	9/16	1700	30	45	17,000	0.125

*60 cycles per second.

for positioning weld nuts, for example, are shown in *Fig.* 14. Special ball socket electrodes, which are free to swivel, can be used in some cases where it is difficult to maintain the necessary parallel relationship between electrode faces.

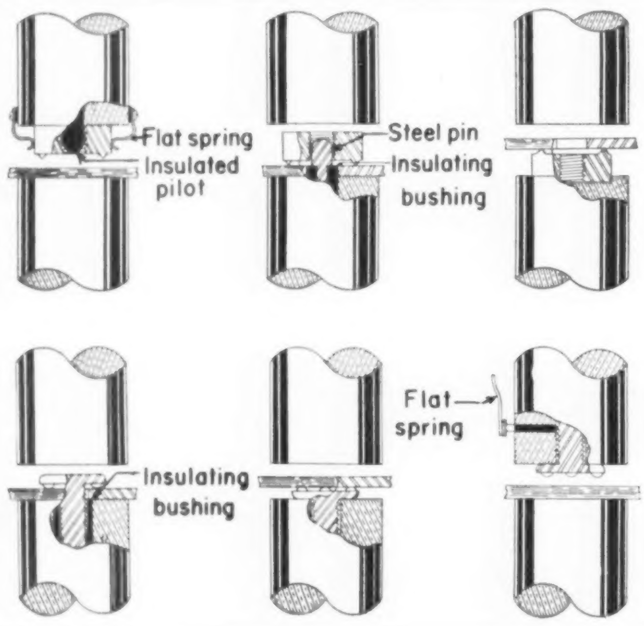
The ingenuity of the tool engineer in providing electrodes specially designed for nesting parts as well as other tooling, can greatly extend the uses of the process. Except for short runs and simple operations, jigs or fixtures are usually necessary. In fact, the success of the job and realization of potentially considerable savings, depend largely on the tooling.

Much the same principles apply to this work as to punch-press production. All holding devices, however, must be insulated and conductors disposed outside the loop as much as possible. On large parts, fixtures of some kind are essential for holding the work, but often a stop-pin pilot or bushing is adequate for locating the weld part. Since the larger percentage of projection welding time is consumed in loading and unloading operations, these should be made simple and fast.

Because of applicability of tooling, projection welding probably affords as great or greater adaptability to production than any of the welding processes. Further, effort spent in design of tooling is usually directly reflected in cost savings. The process is advantageous for all but the shortest production runs and is especially appropriate for assembly automation. When these potentials are fully appreciated by tool engineers the process will undoubtedly realize an even more remarkable growth in the future than it has to date.

Fig. 14. Electrode designs for locating weld screws and nuts. Proper electrodes give optimum welds and frequently avoid need for holding fixtures.

—Drawing courtesy The Ohio Nut & Bolt Co.



Acknowledgments

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American Welding Society............... New York, N. Y.
Buick Motor Div., General Motors Corp....... Flint, Mich.
The Federal Machine & Welder Co.......... Warren, Ohio
Ford Motor Co.......................... Dearborn, Mich.
The Ohio Nut & Bolt Co...................... Berea, Ohio
Precision Welder & Flexopress Corp....... Cincinnati, Ohio
Resistance Welder Manufacturers' Association .... Philadelphia, Pa.
Sciaky Brothers, Inc......................... Chicago, Ill.
Taylor-Winfield Corp....................... Warren, Ohio

Table 3—Projection Welding Process Data for Stainless Steels

Nominal Thickness of Thinnest Outside Piece (inch)	Minimum Electrode Face Diameter (min.) (inch)	Net Electrode Force (lb)	Weld Time (cycles)*	Hold Time (cycles)*	Secondary Welding Current (amps)	Nominal Thickness of Thinnest Outside Piece (inch)
0.014	1/8	300	7	15	4500	0.014
0.021	3/32	500	10	15	4750	0.021
0.031	3/16	700	15	15	5750	0.031
0.044	1/4	700	20	15	6000	0.044
0.062	5/16	1200	25	15	7500	0.062
0.078	3/8	1900	30	30	10,000	0.078
0.094	7/16	1900	30	30	10,000	0.094
0.109	1/2	2800	30	45	13,000	0.109
0.125	9/16	2800	30	45	14,000	0.125

*60 cycles per second.

production tolerances

for die castings

As THE REPRESENTATIVE of job-shop producers of die castings, the American Die Casting Institute is preparing a guide for designers, producers and users. The tables reproduced here are among the first tentative standards to be released. The tabulated values represent normal production practice at the most economical level. Greater accuracy, involving close work and ease in production, can be achieved where its expense can be justified.

Normal production tolerances for critical linear dimensions are shown in TABLE 1, those for noncritical dimensions are listed in TABLE 2. Listed tolerances must be increased if a parting line or moving die part affects the dimension. Dimensions for which tables apply are shown in the sketches as "A." Parting line tolerances, TABLE 3, and moving die part tolerances, TABLE 4, must be added to basic dimension tolerances where they apply. "Projected area" is the area of the die casting in square inches at the die parting plane.

Flatness of a die-cast part is measured with a feeler gage at three widely separated points on a continuous plane surface. Flatness tolerances are shown in TABLE 5. Dimension of the die casting, in this table, means the diameter of a circular surface or the diagonal of a rectangular surface.

Table 1—Tolerances for Critical Linear Dimensions

Length of Dimension "A" (inches)		Zinc (inch)	Aluminum (inch)	Magnesium (inch)	Copper (inch)
Up to 1		±0.003	±0.004	±0.004	±0.007
1 to 12	Add tolerance for each additional inch of "A"	±0.001	±0.0015	±0.0015	±0.002
Over 12		±0.001	±0.001	±0.001	

Table 2—Tolerances for Noncritical Linear Dimensions

Length of Dimension "A" (inches)		Zinc (inch)	Aluminum (inch)	Magnesium (inch)	Copper (inch)
Up to 1		±0.010	±0.010	±0.010	±0.014
1 to 12	Add tolerance for each additional inch of "A"	±0.0015	±0.002	±0.002	±0.003
Over 12		±0.001	±0.001	±0.001	....

Table 3—Additional Parting Line Tolerances
(Based on single cavity die)

Projected Area (square inches)	Zinc (inch)	Aluminum (inch)	Magnesium (inch)	Copper (inch)
Up to 50	±0.004	±0.005	±0.005	±0.005
50 to 100	±0.006	±0.008	±0.008	—
100 to 200	±0.008	±0.012	±0.012	—
200 to 300	±0.012	±0.015	±0.015	—

Table 4—Additional Moving Die Part Tolerances

Projected Area (square inches)	Zinc (inch)	Aluminum (inch)	Magnesium (inch)	Copper (inch)
Up to 10	±0.004	±0.005	±0.005	±0.010
10 to 20	±0.006	±0.008	±0.008	—
20 to 50	±0.008	±0.012	±0.012	—
50 to 100	±0.012	±0.015	±0.015	—

Illustrations of conditions for which tables give tolerances and added tolerances.

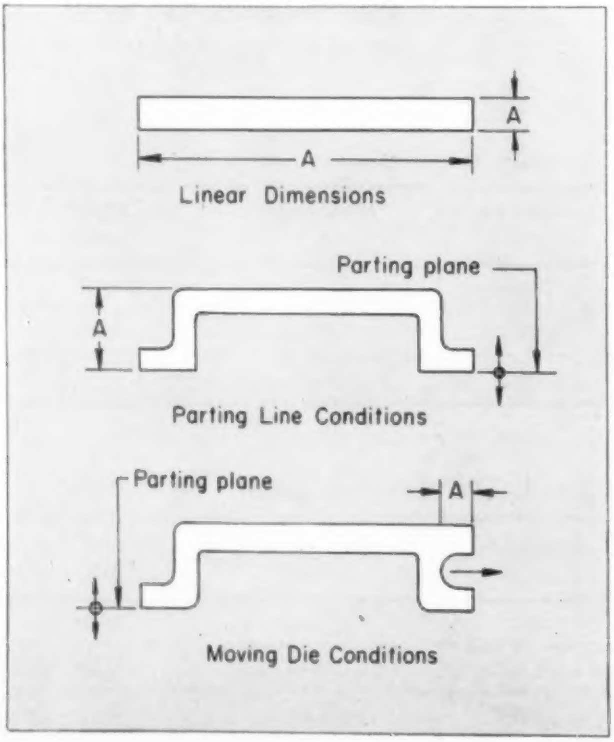


Table 5—Tolerances for Flatness

Dimension of Die Casting (inches)	All Alloys (inch)
Up to 3	0.008
Added tolerance for each additional inch of dimension	0.003

Erratum

All references to "total die clearance" in the reference sheet for March 1955, "Interchangeability of Stock in Die Sets", should read "clearance per side". This is in accord with general practice.

New officers of ASTE held a special meeting in Los Angeles to discuss national committee appointments. Seated, from left: Harry B. Osborn, Jr., president; Harold E. Collins, second vice president; and Howard C. McMillen, first vice president. Standing: Raymond C. W. Peterson, third vice president; Wayne Ewing, fourth vice president; John X. Ryneska, secretary; and H. Dale Long, treasurer.

NEWS

Harry B. Osborn, Jr.

President, 1955-56

THE AMERICAN SOCIETY OF TOOL ENGINEERS

Dr. Osborn, elected at the 1955 annual meeting to the highest office in ASTE, is the 24th president of the Society and the new chairman of the Board of Directors. A member of the Cleveland chapter, he is technical director of the Tocco Division of The Ohio Crankshaft Co.

Before joining the firm in 1939 as research and development engineer, Dr. Osborn was a member of the faculty at Lehigh University, Bethlehem, Pa., where he taught and directed research in the engineering department.

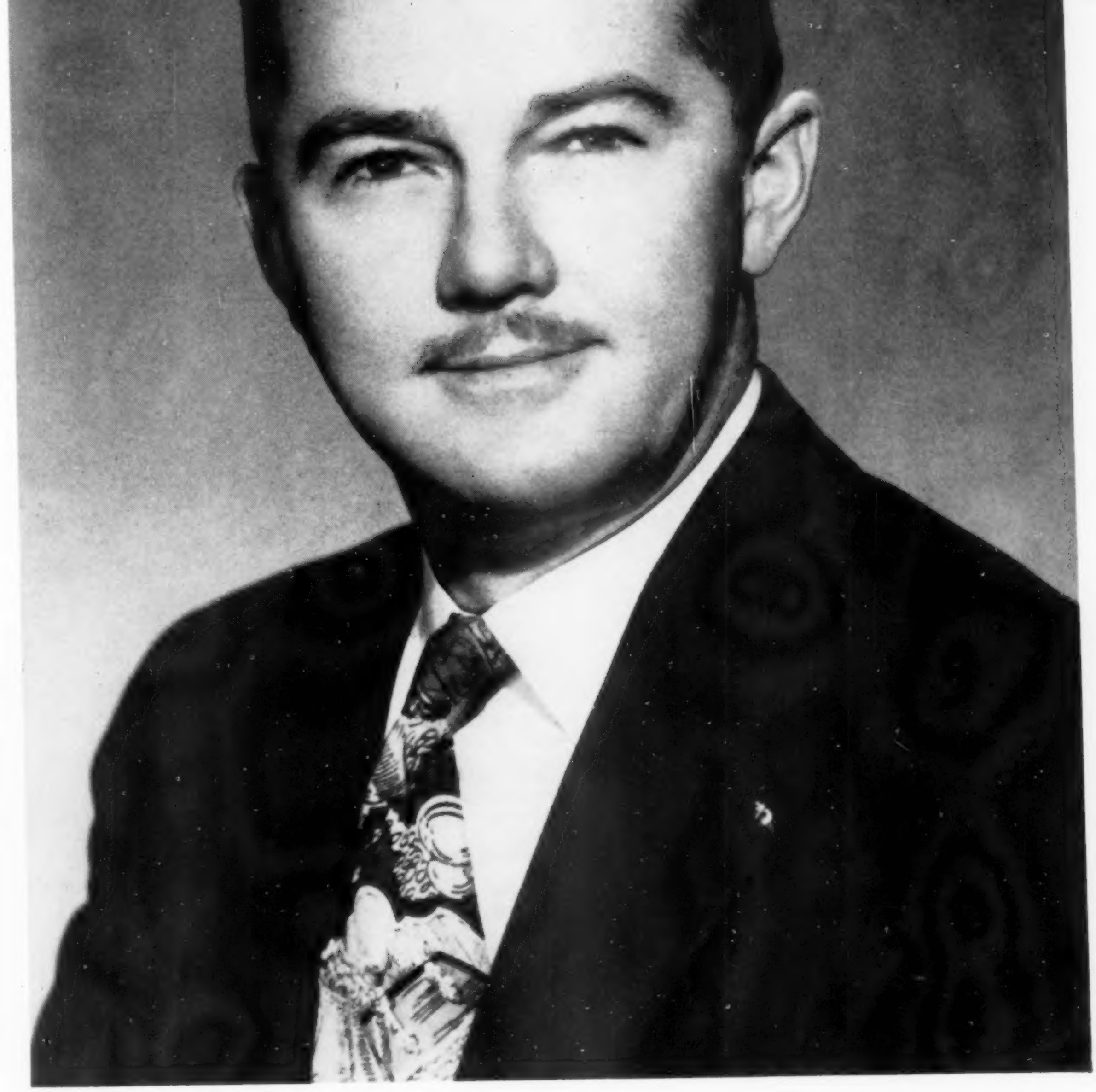
Lehigh is also his alma mater. He served as president of the class of 1932 and later completed work at the university for his M.S. and Ph. D. degrees.

Author of many technical papers and publications on induction heating, Dr. Osborn delivers some 50 talks a year before various technical societies in the United States and Canada, flying his own airplane most of the time to meet tight schedules.

Dr. Osborn is a registered professional engineer, a member of the Professional Engineering Society, American Society for Metals, Cleveland Engineering Society, Association of Iron and Steel Engineers, The Electrochemical Society, Pi Mu Epsilon, Pi Delta Epsilon, Tau Beta Pi, and Sigma Xi, as well as several national defense committees. He is past president of the Cleveland Technical Societies Council, past chairman of the Cleveland ASTE chapter and has held numerous national positions in ASTE.

Dr. Osborn and his family, including two teen-age daughters, live in University Heights, Ohio. He is extremely active in community affairs as a city councilman, a director of the Chamber of Commerce, past president of the Cleveland Heights-University Heights School Board, chairman of the Joint Recreational Board, past president of both the Heights Exchange Club and the Ohio state organization, and president of the Lehigh Alumni Association of Northern Ohio.

In 1946 Dr. Osborn was selected by the Cleveland Junior Chamber of Commerce as "Cleveland's Outstanding Young Man of the Year" and in 1953 he received the "Man of the Year" award from the American Legion.



featured this month

chapter news

Ernest Breech receives award . . . . Prentiss Brown gives address . . . . Visitors register for women's activities

National delegates, above, meet at President's Breakfast. Keen interest marks exposition activity, right.

ASTE's Western Convention

Accented by the warm friendliness which characterizes the West, ASTE's successful convention week in Los Angeles is recorded in many different ways.

For visitors at the Industrial Exposition, the first staged on the West Coast by the Society, March 14 through 18, 1955 are the dates of the most important display of production equipment and accessories ever held in the West.

The exposition drew 10,454 registrants, including practically all of the top officials of the West Coast's rapidly expanding industry, as well as executives and engineers from such distant points as Hong Kong, Saudi Arabia and Australia.

For exposition exhibitors, who represented all

Continued on next page

western convention

Joseph P. Crosby, standing, greets representatives from West Coast chapters at the President's Breakfast at the Hotel Statler. The event launched a full day of activity for ASTE's national delegates.

Continued from preceding page

industrial areas of the United States and Canada, the ASTE convention week means impressive quality attendance, with rich opportunity for establishing new friendships and solidifying old ones.

Summing up exposition results, Harry E. Conrad, executive secretary of the Society, reports that "In view of the fact that it was ASTE's first attempt at such a venture on the West Coast, the over-all results based on quality of attendance and the reaction on behalf of those exhibiting actually exceed all expectations."

For the high percentage of registrants who attended the technical conferences, what was learned at the week's program of top-flight speakers and broad range of industrial topics will be felt 'on the job' for a long time to come. Interest in the visits to key western industrial plants was also high, with most of the tours sold out.

Busy days working on matters affecting all phases of Society chapter and national activity were recorded by members of the Board of Directors and the House of Delegates.

Mrs. Wayne Ewing, center, was in charge of women's activities. Among her aides were Mrs. R. L. Chrissie, left, Mrs. F. X. Bale, right, and Mrs. T. M. Gibson, not pictured.

Photographic coverage of the exposition and annual meeting by Gene Grahn, senior member of the Los Angeles Chapter.

Shown at the directors' luncheon, clockwise from left foreground, are: Fred Kampmeier, William Moreland, G. A. Goodwin, George Bryan, H. B. Osborn, Jr., A. R. Putnam, H. D. Long and J. P. Crosby.

National delegates met to discuss chapter pro-ams, education and membership, before going into eir closed session to elect the 1955-56 Board.

National directors reviewed major policy de-sions, annual reports of all national committees d elected officers for the coming year.

With Harry B. Osborn, Jr., national president, as hairman, the Board of Directors for 1955-56 will nclude the following members: A. B. Clark, Harold . Collins, Joseph P. Crosby, Willis G. Ehrhardt, Vayne Ewing, George A. Goodwin, James O. Horne, I. Dale Long, Howard C. McMillen, William More-and, Raymond C. W. Peterson, Charles M. Smillie, Richard A. Smith and W. A. Thomas.

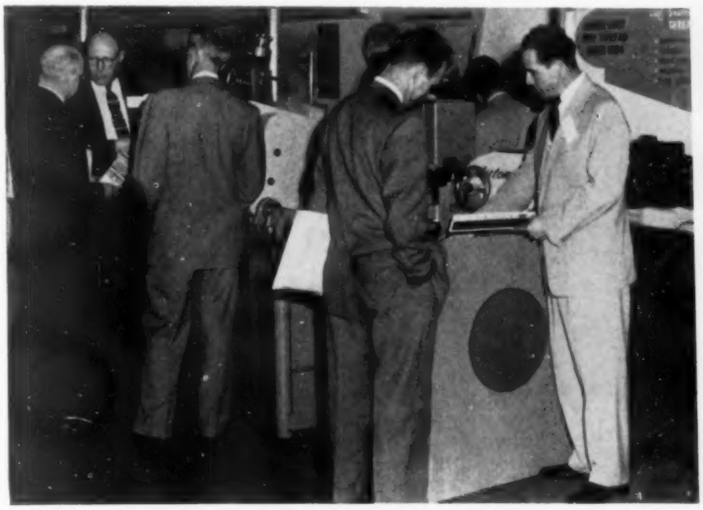
Messrs. Moreland, Peterson and Thomas are new members. Mr. Crosby as retiring president automatically serves on the board, as outlined in the constitution and by-laws.

The annual banquet, with the famed Cocoanut Grove of the Ambassador Hotel as its setting, was sold out almost before the week began. Nearly 900 persons, all generating a party-like atmosphere, ate filet mignon, danced to the music of Freddy Martin and enjoyed the banquet festivities. (See pages 128-130)

Women's activities planned for the week were well-attended and offered a full program of things to do and see in the Los Angeles area. Highlights included a get-acquainted tea at the Ambassador Hotel, and visits to Knott's Berry Farm, Farmers' Market and Huntington Art Gallery.

Many thanks are due members of the Host Committee for their long-range planning, their hundreds and hundreds of hours of work, and their generous hospitality. The smooth-running convention could not have been without them.

A booth demonstration gets the full attention of this group of exposition visitors. Staged at the Los Angeles Shrine Auditorium, the exposition was attended by top executives and engineers.



More than 270 exhibitors, representing all industrial areas in the United States and Canada, utilized 80,000 square feet to the latest in production equipment.

A contingent from Utah State College at Logan traveled to Los Angeles to attend the ASTE Exposition. Instructors and 12 tool engineering students are in the group, including Prof. Frederic Preator, front row, far right.

Greetings were exchanged by the Joseph P. Crosbys, left, and the Harry B. Osborns at a reception preceding the banquet. A few hours later Mr. Crosby joined the ranks of past presidents as Dr. Osborn was sworn in as the 24th president of ASTE.

Annual Banquet

Installation of new national officers, an address on "Atomic Power for Peace" by Prentiss M. Brown and the presentation of the Society's first gold medal awards were highlights of the annual banquet held at the Cocoanut Grove.

The four awards and the recipients are: ASTE Progress Award to Ernest R. Breech, chairman of the board, Ford Motor Co.; ASTE Engineering Citation to Philip M. McKenna, president of Kennametal, Inc.; ASTE Gold Medal to Fred H. Colvin, editor emeritus, *American Machinist;* and Joseph A. Siegel Memorial Award to O. B. Jones, president of the Detroit College of Applied Science and a founder of ASTE.

After the presentations, Mr. Breech paid tribute to the tool engineers and their vital role in the American way of life. In remarks directed to the wives in the audience, he said that their tool engineer husbands are the men upon whom the success of industry depends. Without them, he emphasized, no industrial corporation could exist.

Joseph P. Crosby, retiring president of the Society, installed the new officers and presented the president's pin to Harry B. Osborn, Jr., ASTE president for 1955-56. Other officers for the year are: H. C. McMillen, first vice president; H. E. Collins, second vice president; Raymond C. W. Peterson, third vice president; Wayne Ewing, fourth vice president; H. Dale Long, treasurer; and John X. Ryneska, secretary.

Prentiss M. Brown, right, a director of the Detroit Edison Co., discusses his banquet address on atomic power with Harry E. Conrad, center, executive secretary of ASTE, and John W. Greve, editor of *The Tool Engineer* magazine.

National committee chairmen for 1954-55 seated at this special banquet table, clockwise from left foreground, are: William Schug, membership; John X. Ryneska, constitution and by-laws; L. E. Doyle, professional engineering; Joseph L. Petz, editorial; Francis J. Sehn, book; Edward H. Ruder, public relations; Thomas Barber, program; and Fred Kampmeier, finance.

Left—Ernest R. Breech, chairman of the board of Ford Motor Co., was presented the Society's Progress Award for 1955. Congratulating him is Prentiss M. Brown, right, who was the banquet speaker. In the photograph above, Philip M. McKenna, president of Kennametal, Inc., is shown receiving the ASTE Engineering Citation. Pictured at his right is James R. Weaver, president of the Society in 1939-40.

ATOMIC POWER FOR PEACE

. . . . Prentiss M. Brown outlines goals

With a backdrop of palm trees adding dramatic contrast to the word pictures he painted, Prentiss M. Brown, director, The Detroit Edison Co., outlined to ASTE members attending the annual banquet at the Cocoanut Grove the foreseeable goals in the generation of electrical power via nuclear methods. As a result of intensive effort during the past five years, some semblance of order is emerging. It is well understood, as of today, that nuclear energy cannot be directly converted into electricity. Scientists have discovered nothing to indicate that direct conversion will ever be possible. Instead, nuclear energy will be a source of heat to replace present fuels in the generation of steam.

Although alternative cost studies are the basis of tool engineering, such studies have had little place in the electrical industry. The problem with electrical utilities has always been one of meeting the additional demand. Alternative cost studies have been made to determine the most efficient manner of serving but utilities must serve all comers. Since Edison's light bulb, there have been no "heroic" inventions; no ideas flashing suddenly from the brain of a single individual to revolutionize the industry. Progress in the electrical industry has been the work of the entire industry. Almost all utilities have now joined into several friendly competing groups to solve the problems connected with atomic power.

Two small reactors have been built as laboratory experiments and operated to produce electricity. Another unit is being built near Pittsburgh. In a broad sense, this is like carrying coals to Newcastle. This reactor has a design capacity of more than 60,000 kw and is expected to go into operation in 1957. This will be the first reactor large enough to indicate the significance of atomic power in the peaceful field of power generation.

Many people do not understand the sheer magnitude of the problem of supplying power to meet this country's needs. A recently installed steam turbine generator has a design capacity of 300,000 kw. Nuclear reactors will have to match such capacities for central station use and be reliable.

In the long run, atomic fuels for power generation can be justified only when the cost of the power produced is not greater than the cost of that produced by conventional methods. Customers cannot be expected to pay more for power simply because it is produced by atomic fuels. From the practical standpoint, the problem is one of using what is claimed to be a low-cost heat energy source in place of present fuels. It is anticipated that the saving in fuel cost will more than outweigh the high reactor cost.

According to present law, atomic fuels are owned by the government. The only sources of these materials are the AEC military production facilities. Under the present setup, real costs of the fuels cannot be determined.

Continued on p. 135

Banquet Candids

Pictured at the reception for officers, directors and national committee chairmen are Mr. and Mrs. Howard C. McMillen, left, and Mr. and Mrs. Harold E. Collins. Prentiss Brown and the recipients of ASTE Gold Medals were special guests.

Mrs. Francis J. Sehn, Mrs. John X. Ryneska, Mrs. Raymond C. W. Peterson and Mrs. Robert E. McKee compare notes on the various activities held for the wives during exposition week.

For these host committee members, the banquet climaxed almost a year of work.

Checking notes before the panel on manufacturing management, from left, are: A. A. Signorelli, E. W. Ernst, J. R. Weaver, who was moderator, and H. W. Linton, session chairman. Other participants in the discussion were: R. J. Gould, R. J. Mountain and Stanley C. Pace.

Developments in tool engineering research were discussed at a conference presented (from left) by: Ray H. Morris, moderator; Col. L. S. Fletcher; Dr. Erik K. Hendriksen (foreground); Dr. A. O. Schmidt; and Carl Oxford, Jr. Most of the conferences were held at the Shrine Auditorium.

Technical Speakers

Frank Wilson, right, ASTE technical director, briefed speakers before the session on toothed products. From left: Harry Pelphrey, B. Stanley Wright, Fred Bohle and H. B. Keys.

Covering material for the program on numbering codes, clockwise from left foreground (front table only), are: James V. Coulter, H. Dale Long, Matthew Margulies, Vincent A. Petricola, Dr. Mortimer Taube, John P. Dobbins, James A. Catto and Ralph L. Chrissie.

Arrangements for the panel on plastic tooling, co-sponsored by the Society of Plastics Engineers, were reviewed (clockwise from left foreground) by: John Delmonte, Richard Morozowicz, Frank Wilson, G. J. Walkey, Ben J. Hazewinkel (national director of ASTE), Richard Bacik, Louis E. Frost, George C. Adams and Walter H. Kadlec.

On Campus Conferences

Programs Set for Michigan State, MIT and University of Tennessee

Three leading universities have scheduled ASTE on-campus conferences for the month of May. The Massachusetts Institute of Technology will hold its first one-day program on May 7. On the same week end, the University of Tennessee will also hold its first conference, a two-day program, on May 6 and 7. The following week end, on May 14, Michigan State University will hold its second such conference.

Members in these areas who would like to brush up on some of the latest production and processes techniques combined with some fellowship and exchange of ideas, should make special note of these dates.

The MIT conference in Cambridge, Mass., starts at 8:30 in the morning with registration. Sponsored by the Massachusetts Chapter of ASTE, the day's program lists five technical talks, a luncheon and visits to Metals Processing Laboratory to see the digitally controlled milling machine.

Conference speakers include: Prescott A. Smith, associate professor of mechanical engineering, MIT, on "Instrumentation for Metal-Cutting Research"; Milton C. Shaw, professor of mechanical engineering in charge of the Division of Metals Processing, MIT, on "Tool Life and Machinability"; and Nathan H. Cook, associate professor of mechanical engineering, MIT, on "Principles of Grinding."

Also on the program are Charles Clark of Cincinnati Milling Machine Co., on "Economics of Equipment Replacement"; and L. D. Miles, of General Electric Co., on "Value Analysis."

Co-sponsored by ASTE and ASME in cooperation with Department of Mechanical Engineering, the conference at the University of Tennessee will be held in the Moot Court Room in the University's Law Building.

Registration at 8:30, Friday, May 6, begins a day and a half of activities including six technical speakers, a banquet, a luncheon, and tours of engineering facilities at the University. The program ends Saturday at noon.

In keeping with the theme of "Metals Processing," sessions include: "Die Casting" by P. W. Marshall, plant superintendent, Doehler Jarvis Co.'s Zinc Div.; "Shell Molding" by W. S. Thomas, vice president, Emmaus Foundry and Machine Co.; "Recent Developments in Machining Research" by Dr. M. Eugene Merchant, assistant research director, Cincinnati Milling Machine Co.; "Research in Metal Turning" by J. C. Hebert, manager, Machine Tool Div., Jones and Lamson Machine Co.; "Drilling and Tapping" by Carl J. Oxford, Sr., research engineer, National Twist Drill and Tool Co.; and "Metal Stamping" by James M. Leake, president, Leake Stamping Co.

The Friday evening banquet will highlight a talk by Hartley W. Barclay, editor, management analyst and author, New York Times.

Michigan State's conference, sponsored by central Michigan chapters of ASTE and the MSU Department of Mechanical Engineering, will be held May 14. Registration is at 8 a.m. on the second floor of the Union Building. The fore part of the morning will be devoted to touring the campus and engineering facilities.

An 11 a.m. session will feature a welcoming address by Dean Ryder and a talk by Howard C. McMillen, national first vice president of ASTE, on "The Tool Engineer of Tomorrow."

The luncheon will be opened by Chairman M. Smillie, a national director of ASTE; and Carl J. Oxford, Jr. will take over as master of ceremonies. Main speaker will be Philip M. McKenna, president of Kennametal, Inc.

The afternoon will be devoted to a talk by Prof. O. Brown of the Department of Production Engineering, University of Michigan, on "Properties and Machinability of Titanium" and a panel discussion. Raymond C. W. Peterson, national third vice president of ASTE, will be chairman of the discussion. Panelists include W. E. Burnett, chief engineer; C. F. Kramer, chief body engineer; and P. M. Clayton, chief engineer; all of Ford Motor Co. The day's activities wind up with a coffee hour.

New Chapters of ASTE

Ever-growing ASTE continues to add new chapters to its roster. Charters have been granted to chapters at Keene, N. H., Oklahoma City, Oklah., Longview, Texas, and Ashtabula, Ohio, as well as to student chapters at Alfred State Tech and Purdue University. Watch for complete details and pictures which will be carried in The Tool Engineer magazine for June.

New Haven Hears Panel on Pressworking

National ASTE Director Richard Smith was the installation officer at New Haven's March meeting. The past chairman's pin was given to John Brozek. Preceding the ceremony, three affiliate membership plaques were presented to representatives of Sargent & Co., Lux Clock Co. and American Brass Co.

The technical program was given by a three-man panel on the subject of pressworking of metals, design of dies and their operation. Mr. Brozek was moderator. Other participants were: Herbert F. Jahn, president, Jahn Mfg. Co.; Stephen Lasto, secretary-treasurer, Lacey Mfg. Co.; and Howard Swanson, manager, H. F. & M. Tool Co.

Also held in March was an educational series of three lectures on machine and tool design sponsored by the New Haven chapter at Mason Mechanical Engineering Laboratories. Offered free to ASTE members, the series carried a $3 registration fee for all others, with the understanding that the fee would be applicable to membership in ASTE any time prior to the conclusion of the course.

Speaker at the three meetings was Paul J. DesJardines, sales and standards engineer for Pratt & Whitney, division of Niles-Bement-Pond Co. Albert Morton was appointed technical chairman. Course registrar was Wilbur Sullivan. —*Siles W. Becroft*

Die Casting Film Shown at Springfield, Mass.

A film produced for the American Zinc Institute, Inc., entitled "Die Casting—How Else Would You Make It?", was shown Mar. 14 for members of the Springfield, Mass., chapter. Also on the technical program was a talk on hydraulics given by E. O. Clark, manager of industrial products sales, Vickers, Inc.

Installation of new officers was conducted by Wendell T. Ingham, past chairman of the chapter. About 110 members and guests attended the session. —*George H. Foy*

Wayne Ewing Installs Tucson Officers

Installation of officers and a dinner dance made up the program for the Tucson meeting held March 5 at El Rio Country Club. Wayne Ewing, now fourth vice president of the Society, swore in the new officers. About 65 members and guests were in attendance. —*Joseph W. Vincent*

EDUCATORS' CONFERENCE—Sponsored by the National Education Committee, a conference was held for leading educators in engineering education at the annual meeting. The speaker table included: seated, from left, Prof. M. L. Begeman; R. B. Niebusch; H. C. McMillen, new first vice president of ASTE; and Prof. R. E. McKee, chairman of the National Education Committee. Standing are: H. E. Collins, new second vice president of ASTE, Prof. O. D. Lascoe; Prof. Frederick Preator; and Prof. C. C. Lasater.

New Committee Chairmen Named

One of the first official duties of Harry B. Osborn, Jr., as new president of the Society, was appointing the men who will head up the various ASTE national committees for the coming 1955-56 term. Dr. Osborn has named six new chairmen.

Vincent M. Spahr of Lima succeeds John X. Ryneska as chairman of the National Constitution and By-Laws Committee. Mr. Spahr served on the Committee the previous term and is methods engineer at Baldwin-Lima-Hamilton Corp. Mr. Ryneska was elected national secretary of ASTE.

H. Verne Loeppert of Chicago goes to the head of the National Membership Committee succeeding William W. Schug. Mr. Loeppert, who has served three terms on the Committee, is vice president and general manager of Boyd Wagner Co.

Leslie C. Seager of Salt Lake City assumes the National Professional Engineering Committee chairmanship previously held by Prof. L. E. Doyle of the University of Illinois. Chief production engineer at Eimco Corp., Mr. Seager is currently serving his third term as a member of the Committee.

Philip R. Marsilius of Fairfield, Conn., a member of National Program Committee for two terms, takes over its chairmanship from Thomas C. Barber. Mr. Marsilius is vice president of Producto Machine Co. in Bridgeport, Conn.

Wilfred B. Wells of Chestnut Hill, Mass., will direct activities of the National Public Relations Committee taking over responsibilities of Edward H. Ruder. Having served on the Committee for two terms, Mr. Wells is vice president of Waltham Precision Tool Co., Waltham, Mass.

William Moreland of Rockford, Ill., has been appointed chairman of the National Standards Committee, a post previously held by George F. Bryan. Mr. Moreland who has served on the Standards Committee since 1945 is assistant works manager at Greenlee Brothers & Co.

Reappointments included: **Francis J. Sehn,** vice president and sales manager of Sahlin Engineering Co., Birmingham, Mich., National Book Committee; **Joseph L. Petz,** secretary-treasurer of Petz-Emory, Inc., Poughkeepsie, N. Y., National Editorial Committee; **Robert E. McKee,** associate professor of production engineering, University of Michigan, Ann Arbor, Mich., National Education Committee; and **Fred Kampmeier,** vice president and chief engineer of Ingersoll Machine Co., Rockford, Ill., National Finance Committee.

Two of the Society's national committees are made up entirely of ASTE's past presidents. **Walter Wagner** of Detroit moves up as chairman of the National Honor Awards Committee and T. Bert Carpenter retires. The National Judicial Committee chairmanship is retained by **William H. Smila** of Detroit.

Robert B. Douglas of St. Eustache, Quebec, Canada, past president of ASTE, continues as head the Research Fund Committee.

Mohawk Valley Elects New ASTE Officers

At the election meeting held in February, members of the Mohawk Valley chapter chose their officers for the coming year. They include: Raymond B. Hurley, chairman; Nicholas A. Kinney, fiirst vice chairman; Richard A. Lauterbach, second vice chairman; Paul L. Lyman, secretary; and Harold L. Bartlett, treasurer. The evening's program also included several films, one on the story of aluminum, and the others on sports topics. The meeting was held Feb. 22 at the Club Monarch, with an attendance of 25. —*Ernest J. Masveci*

R. B. Hurley

PEORIA—Shown at the March installation meeting, from left, are: Duanne Brighton, past chairman; Vic Schellschmidt, chairman; H. Dale Long, ASTE National Director and treasurer who conducted the installation; D. A. Trescott of Supercut Distributors, Inc., who presented a film on modern diamond mining; and Fred Logsdon, technical chairman for the program.—*Russ Saurs*

A. B. Clark Guest at Albuquerque

A. B. Clark, a national director of ASTE, was special guest of the Albuquerque chapter at its Mar. 10 meeting held in the Fez Club. Mr. Clark installed chapter officers for the coming year.

Another highlight of the program was the presentation of certificates of appreciation for outstanding service by the Joint Council of Technical and Scientific Societies in Albuquerque to five chapter members. They were given to Fred Deiber, Harold Baecker, Jerome Durrie and Nick Sannella by A. Burton Metzger, president of the Council. Mr. Sannella also received the chapter service award pin.

Technical speaker was Al Good, tool engineer for American Car and Foundry Industries. —*H. E. Anderson*

H. L. Tigges Installs Officers at Toledo

Past president of ASTE and executive vice president of Baker Bros., Inc., H. L. Tigges was the installation officer at Toledo chapter's March meeting. The ceremony shared the spotlight with ladies' night activities planned for the evening. The program, which also offered dinner and dancing, was held at the Maumee River Yacht Club. The service pin was presented to Joe Hojnocki for his outstanding work during the year as head of the standards committee. All officers and committee chairmen, as well as Raymond C. W. Peterson, now third vice president of ASTE, were introduced to the members and wives in attendance. —*Harold H. Krueger*

Walter Toepfer
Chairman

Northern New Jersey Honors Executives

At its annual executives' night program, members of the Northern New Jersey chapter were hosts to a number of officials from some of the largest manufacturing firms in the area.

The program included installation of officers by National Director Richard A. Smith, who spoke on "News from Headquarters," and a talk by John R. Gates, manager of mechanical equipment design, Tube Div., Radio Corp. of America. Mr. Gates described the tool problems encountered in the development of the modern electronic tube of today.

Precision Diamonds Topic at Fort Wayne Meeting

"Precision Diamonds in Industry," was the subject matter of a talk given by Jan Taeyaerts for the members and guests of Fort Wayne chapter on Mar. 9. Mr. Taeyaerts is president of Precision Diamond Tool Co.

Coffee speaker, Dr. Richard Bateman, director of the Fort Wayne Center at Purdue University, was presented a Tool Engineers Handbook for the library at the Center. D. Allen Bauer, education chairman, made the presentation.

Committee chairmen appointed by Chairman Josef Deck include: Richard W. Good, program; Eugene Gildea, Jr., entertainment; Alfred E. Peterson, membership; Robert H. Bienz, editorial; Paul Peterink, public relations; Richard G. Spaw, industrial relations; Frank J. Manning, standards; D. Allen Bauer, education; Gene E. Hoover, sick and welfare; Harry A. Hartman, professional engineering; and Charles A. Haugk, advisory.

—*Robert H. Bienz*

FORT WAYNE—Officers of the Fort Wayne chapter were installed on Mar. 9 by H. Dale Long, assistant secretary-treasurer of ASTE for 1954-55. From left are: Dave Chambers, secretary; Eugene Gildea, Jr., second vice chairman; Josef A. Deck, chairman; Mr. Long; Richard W. Good, first vice chairman; and John B. Thimlar, treasurer.

Atomic Power for Peace

(Continued from page 129)

None of the reactors now being built or planned will be able to produce electricity at costs competitive with current methods. However, experience gained with these reactors may make it possible to improve the systems and achieve a competitive position. It will be three to five years before the present reactor program is completed and operating results are evaluated. Another three to five years will be required before the improved reactors can be built and tested. It will be eight to ten years before atomic power development is carried to a point where its feasibility can be estimated.

Concern has been expressed many times that atomic power will make present power generating plants obsolete and devalue present investment in power systems. It is not anticipated that the successful accomplishment of a competitive position by atomic plants will greatly influence present systems. Atomic fueled plants will be installed to meet new power requirements; existing plants will serve out their normal economic lives.

There is strong belief that atomic power will ultimately be developed on a commercially competitive basis. When it is considered that a quantity of atomic fuel about the size of a cigar could supply the demand for power in Los Angeles for 12 hours, it can be seen that the goal is worth the effort. Also, it is apparent that this new fuel is abundant. Reserves seem to be far greater than those for coal or oil.

The major benefit from atomic energy is the assurance of an abundant source of heat energy that can be used for power generation during the years that lie ahead. American industry is betting that this will be so. Four industry study groups have been approved by and are operating under agreements with the Atomic Energy Commission. One study project is now backed by 33 companies. Among these companies are 25 that supply about 35 percent of the power consumed in the United States. Currently, this project is concerned with the design of a breeder reactor; a reactor that will use the full heat potential of uranium instead of the small part that is used in the recently tested submarine propulsion reactor.

It is the hope of industry to make this potent force a servant, not a destroyer, of mankind. The atom, in the control of a desperate or dying despot, out of his mind in rage at his defeat, might destroy civilization. The very power of the fully developed atom makes its control necessary to mankind. Tolerance toward and understanding of the problems of the other nations of the world, to a greater extent than ever before, is vital to survival.

CENTRAL PENNSYLVANIA—Installation night was held Mar. 2 at the West York Inn. Directing activities for the Central Pennsylvania chapter will be, seated from left: W. D. Gross, secretary; D. B. Spatz, chairman; and L. D. Roberts, treasurer. Standing are: R. H. Meckley, alternate delegate; E. T. Wenrich, first vice chairman; H. B. Berra, second vice chairman; and J. C. Rodgers, national delegate.

Pennsylvania Chapter Names Committee Heads

Central Pennsylvania chapter's committee chairmen for 1955-56 have been named. Serving with the officers will be: R. E. Livingestone, constitution and by-laws; P. F. Leese, editorial and ASTE directory committee; A. F. Linden, membership; B. C. Stambaugh, standards; E. J. Haverstock, program; L. W. Myers, public relations; J. G. Williams, education; D. A. Schrom, professional engineering; R. W. Rohrer, meetings; and C. T. Gilbert, historian.

—*Paul F. Leese*

Milwaukee Honors Past Chapter Chairmen

Members who have served as chairmen of the Milwaukee chapter were special guests at the March 10 meeting. Present for the meeting held in their honor were: E. Rutzen, T. Riedl, A. Geringer, F. Koehn, P. Wernicke, Z. Ebner, P. Butzin, A. Gudert, H. Heimann, W. Behrend, and W. Klein.

The program for Past Chairmen's Night was highlighted by a talk on the art of selling and merchandising by Glenn B. Elliott, assistant to the president of the Evert Container Corp.

—*Walter Behrend*

BUFFALO-NIAGARA FRONTIER—Hotel Niagara was the scene of the Buffalo-Niagara installation night on Feb. 26. Dr. Harry B. Osborn, Jr., ASTE national president for 1955-56, was the installing officer. From left are: Russell W. Fitch, second vice chairman; Dr. Osborn; Robert S. Slate, first vice chairman; Harvey W. Ellis, chairman; Arthur F. Thormahlen, secretary; and J. Robert Fiscus, treasurer. Dinner, Monte Carlo games and dancing rounded out the evening.—*Harry W. Ellis*

Harry Conn Addresses Cincinnati Chapter

Harry Conn, chief engineer, Scully-Jones & Co., was the guest technical speaker at the Mar. 8 meeting of the Cincinnati chapter. Approximately 95 members and guests were present to hear Mr. Conn's talk on "Tooling for Automation."

—*Barton Jones*

LIMA—Past Chairman Ray Schimpf congratulates new Lima chapter officers whom he has just installed at the March 24 meeting. From left are: Mr. Schimpf; Vincent M. Spahr, treasurer and chairman of the National Constitution and By-Laws Committee; Gene Siferd, secretary; W. E. Epley, second vice chairman; John E. Kuck, first vice chairman; and H. W. Carey, chairman.

SPRINGFIELD, ILL.—New officers, from left, are: LeRoy Rasch, national delegate; C. A. Woodcock, chairman; P. F. Dirksen, first vice chairman; M. D. Bergeson, second vice chairman; and Ross McNutt, secretary. Recipient of the chapter's service pin is Donald Flynn. March technical speaker was H. V. Harding, assistant to the president, Elox Corp.—*Charles Collier*

ROCKFORD—Officers for 1955-56, standing from left, are: H. Walter Lewis, secretary; Marshall Samuelson, third vice chairman; and Joel Jannenga, first vice chairman. Seated: Walter Fraser, second vice chairman; Ernst Norrman, treasurer; and Alfred Oman, chairman. A panel discussion by three Rockford business men rounded out the program. H. Dale Long, ASTE national treasurer, installed the officers.

Chautauqua-Warren Officers Installed

Officers of the Chautauqua-Warren chapter were installed at the Mar. 10 meeting held at the Marconi Outing Club near Warren, Pa. They were sworn in by William J. Iekel, area lieutenant of the National Membership Committee.

Harry H. Swartzfager received the service award for his contributions to the chapter as professional engineering chairman. Another highlight was the presentation of the ASTE banner by Herbert Cave, past chairman, to Chairman Gordon H. Carlson.

The technical program featured two speakers—D. R. Percival, manager, and P. Dunnigan, assistant general manager, of Machinery Electrification, Inc. They spoke on the advisability of applying electronic drives and controls to machinery. —*Walter N. Carlson*

Installation Held at Lima Meeting

Eighty members and guests were in attendance for the installation of officers and to hear William N. Karns speak on "Ultrasonic Machining of Hard Materials." The meeting was held March 24 in the Royal Pine Room of the New Clemans Building and preceded by an "Old Irish Dinner."

Recipient of the service award pin was Bill Waters. Mr. Waters received it from Bob Fromson for his outstanding work as chairman of the advertising committee. New members present included: John James, Norman Pinnow, Neil Leininger and Wendell Hank.

Mr. Karns, a graduate of General Motors Institute, discussed the Sheffield "Cavitron." —*Donald Cox*

Jack Page Heads New Orleans Officers

Officers for the coming year were installed at the New Orleans March meeting by A. B. Clark, member of the ASTE Board of Directors. Sworn into office were: Jack W. Page, chairman; Milton P. Chatry, first vice chairman; Ed Setterbo, Jr., second vice chairman; Roy Surgi, secretary; and William Fricke, Jr., treasurer.

Mr. Clark spoke on national activities of the Society and discussed some of the current objectives. Another speaker was Hugh Bowery of the New Orleans Association of Commerce who described the industrial development taking place in the area.—*Joseph Natal*

PETERBOROUGH—Chapter officers pictured, from left, are: Selwyn Pritchard, second vice chairman; Neil Huck, secretary; Bruce MacKenzie, chairman; Doug Simpson, third vice chairman; Bert Jeffries, national delegate; and Jack Olaveson, treasurer. Hugh Heslip is the new first vice chairman.—*D. Simpson*

Golden Gate Installs New Officers

Ben J. Hazewinkel, national director of ASTE for 1954-55, attended the Mar. 23 meeting of the Golden Gate chapter to install the new officers. Committee appointments were also announced. They are: Newell Partch, program; Jim Brennan, publicity; John Wilson, editorial; Clifford B. Marker, education; Walter Gustafson, professional engineering; John F. Sullivan, constitution and by-laws; Gottfried Ziegler, standards; Charlie Driesbach, membership; and Pen DeRoche, photography.

The outstanding member of the year award went to Gustave (Ben) Berlien, past chairman of the Golden Gate chapter and a member of the National Editorial Committee.

Wesley Taft Benson presented a talk on "How to Make Money by Proper Use of Accounting," courtesy of the National Association of Manufacturers Speakers Bureau.

On Mar. 1, Chairman-Elect Ted Lindquist called a special meeting of all past chairmen to serve as an advisory committee. The aim is to take advantage of the years of experience gained during office. Fourteen past chairmen and elected officers attended the meeting.

—*Ernest H. Romine*

Heat Treatment Topic at Little Rock

Members and guests of the Little Rock chapter met at Hank's Dog House on Mar. 1 to hear a talk by Robert Spillett on "Heat Treating." Mr. Spillett is with Crucible Steel Co. Four members received ASTE pins for signing new applicants.

—*R. W. McKinstry*

Ottis Dresslar Installs Nashville Officers

Past Chairman Dressler conducted the March installation of officers for the Nashville chapter. The technical portion of the meeting was turned over to Ralph Wagner, chief tool engineer, Crosley Bendix Co., a division of Avco Mfg. Corp.

Assisted by Charlie Winters, chief sales engineer for the firm, Mr. Wagner explained and demonstrated with model jigs how the axiomatic system of building duplicate jigs for airplane manufacturing works. With this system, sections of planes can be built in different plants and the parts will coordinate and fit together whenever they are assembled. —*Harry O. Collins*

TE Day to be Sponsored by Canadian Chapters

The Canadian chapters of ASTE are sponsoring Tool Engineers' Day to be held at the Canadian International Trade Fair on June 3 in Toronto. A highlight of the day's activities will be the Canadian Chapters Luncheon which will take place at 12:30 in the Trade Fair Conference Room on the balcony of the Automotive Building.

Guest speaker at the luncheon, Ralph E. Cross, executive vice president of The Cross Co. of Detroit, will addresss the group on the timely subject of "Automation." Mr. Cross, a graduate of the Massachusetts Institute of Technology, is a pioneer in the development of pre-set tools for high production machines to reduce down time and improve quality.

For eleven months during 1954, he served with the Department of Commerce, and in December 1954 he was named to the Assistant Secretary of the Air Force for Materiel. In this capacity he directed development of a defense reserve of machine tools for the Air Force. He is a member of ASTE, and past chairman of the public relations committee for the National Machine Tool Builders' Association.

The cost of the luncheon is $3. For further information write without delay to A. Underwood, Jr., 433 Fairview Blvd., Riverside, Ontario. Reservations should be made by May 13.

RACINE—Robert Freres, left, newly elected chairman, officially receives the Racine chapter's charter which he will keep in his possession for the year he is in office. Making the presentation at the installation meeting held at the hospitality center of the Miller Brewing Co., Milwaukee, is Maurice Otto, right, retiring chairman and national delegate. Others shown, from left: Vitas Thomas, second vice chairman; Dale Long, treasurer and national director, who installed the officers; Paul Bunck, treasurer; and Bon Monfeli, secretary. The service pin was awarded to Byron L. Peterson for his outstanding work as chairman of the education committee.—*Alvin J. Michna*

D. J. Davis of Ford Motor Co. Elected to Research Fund Committee

By unanimous action taken by the Board of Directors of the American Society of Tool Engineers, D. J. Davis has been elected to membership in the Research Fund Committee.

Having spent all of his industrial career in toolmaking and designing, and in administrative posts supervising manufacturing activities, Mr. Davis is eminently qualified to help in the direction of research in tool engineering. Election to this committee follows closely the announcement of his election as vice president in charge of manufacturing for the Ford Motor Co.

Mr. Davis was born and educated in Detroit, and has devoted much of his time to the automotive and related industries. He was employed variously as a tool designer by the Aluminum Casting Co., the Ainsworth Manufacturing Co. and the Cadillac Division of General Motors Corp. He was with Cadillac for 21 years as a member of the production engineering staff.

In 1942 Mr. Davis was named master mechanic of the American Propeller Corp., Avco Corp. Fully conversant with the limitations of production processes, materials and equipment from the viewpoint of the manufacturing engineer, he brings to the committee an understanding of production process limitations as seen by a design engineer. For about two years, starting in 1944, Davis was chief design engineer of Avco's post-war products. He left Avco from the position of chief industrial engineer and, in 1949, joined Ford as director of the manufacturing engineering offices.

Mr. Davis

Massachusetts Speaker Discusses Copper Brazing

Lloyd E. Raymond, metallurgist and manager of heat treating for Singer Mfg. Co., spoke on general principles and practices in copper brazing at the Mar. 15 meeting of the Northern Massachusetts chapter. He was introduced by R. W. Huxtable.

Installation of the chapter's new officers was conducted by Glen H. Stimson, past chairman and national delegate for 1955-56. The past chairman's pin was presented to J. Robert Moore. The outstanding service award went to William T. McBride, advertising chairman for the past year. —*Otto S. Nau*

Oliver Heads Windsor Officers for 1955-56

Installation of officers at Windsor's March meeting was handled by Raymond C. W. Peterson, third vice president of the Society. Sworn in were: Sidney Oliver, chairman; Ernest Clifton, first vice chairman; W. N. Moore, second vice chairman; Donald Nesbitt, treasurer; and Ross Goulin, secretary.

The technical talk on "Automatic Lubrication of Machinery" was made by M. J. Greenman of the J. N. Fauver Co.

Committee appointments include: E. W. Harris, public relations; Albert Underwood, Jr., program; M. Hollo, education; Joseph Hoba, professional engineering; D. L. Swan, standards; John Tingle, constitution; Donald Rail, editorial; and K. J. Libby, membership. —*F. D. Rail*

Appointments Announced by Raymond E. Holbrook

Committee chairmen of the Southeastern Massachusetts chapter were named at the March meeting by Raymond E. Holbrook, new chairman of the organization. They are: Reginald A. Chandler, arrangements; John H. Somers, constitution; Karl W. Nittel, editorial; Wilfred Bowler, education; Carrol C. Stevens, membership; Howard C. Tinkham, professional engineering; Clarence E. Boynton, program; Adrien H. Desrosiers, public relations; and Malcolm A. MacLean, standards.

The appointments were announced during the ladies' night and installation meeting held March 22. Chapter officers for the coming year were installed by National Director Richard A. Smith. John Cieplik was awarded the service pin for outstanding work for the chapter. —*Karl W. Nittel*

CALIFORNIA ENGINEERING INSTITUTE—These advanced students from the California Institute of Tool Engineering in Los Angeles took time out from classes to visit the ASTE Exposition. Matthew Margulies, extreme left, is the director of the institute and education chairman of the San Fernando chapter of ASTE.

B. N. DeRoche Presents Santa Clara Program

Slides of the 1954 ASTE exposition in Philadelphia and of new plant of the Ford Motor Co. were shown March 8 at the installation meeting of Santa Clara Valley chapter. The showing was made by B. N. DeRoche, assistant to the publisher of *Western Machinery and Steel World*.

Committee appointments announced at the meeting were: Bill Lanyon, program; Bill Forbes, editorial; Jim Romo, public relations; Dr. Lawrence Cook, professional engineering; John J. Johnson, standards; Wilbur Ball, membership; Paul Sturm, historian; and Frank Sheldon, constitution.

—*Bill Forbes*

H. C. McMillen Installs Indianapolis Officers

Howard C. McMillen, now first vice president of ASTE, installed Indianapolis officers at the chapter's March 3 meeting held at Sahara Grotto. It was also past chairmen's night and 114 members and guests attended. Eight past chairmen were on hand. The chapter service award pin went to Al Mendez, editor of the chapter bulletin.

The technical portion of the program consisted of a three-man tool steel panel discussion. Panelists were: Adolph Sheid, vice president of Columbia Tool Steel Co.; Edward Pavesic, director of research, Lindberg Steel Treating Co.; and Art Love, superintendent, Merz Engineering, Inc. The panel members discussed selecting the proper type of tool steel and proper heat-treating methods. —*Murray Davidson*

Kenneth Williams Talks at Montreal Session

Speaker at Montreal chapter's installation meeting was Kenneth Williams, senior sales engineer, Abrasive Engineering Branch, The Carborundum Co. His discussion on methods of precision and production grinding was illustrated with slides and motion pictures.

Committee chairmen named for the coming year include: T. Nashman, program; F. Winkworth, membership; F. C. Henderson, editorial; M. Masse, constitution and by-laws; G. Henderson, public relations; L. Poirier, education; C. A. Gareau, standards; and G. Walker, registration.

In February the chapter heard a talk on "Latest Developments in Thread and Tap Design" by William J. Neilson, Jr., sales manager for Greenfield Tap & Die Co. —*F. C. Henderson*

MONTREAL—Installation of officers was a highlight of the March ASTE meeting. From left are: C. McDowell, past chairman who conducted the ceremony; T. Tracey, chairman; J. H. Currie, first vice chairman; T. Nashman, second vice chairman; F. C. Henderson, treasurer; and J. Dodge, secretary.

Positions Wanted

INDUSTRIAL REPRESENTATIVE—Past chairman of Canadian chapter, age 39, widely connected with 20 years' industrial background. Present position works manager. Previously acted successfully as sales manager, production manager, project engineer and purchasing agent. Now interested in representing progressive American manufacturer of industrial equipment in Canada. Write to Box 023, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

FACTORY MANAGER—wishes plant with diversified products in metal trades. Three years' experience. Met and bettered competition. Outstanding management, production and engineering record, extensive practical shop experience, large corporation training, inherent mechanical ability, ME degree, unusual background. Always able to earn confidence and create enthusiasm in employees. Present salary: $12,000 base. Age 32. Write to Box 038, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

PRODUCTION OR MANUFACTURING ENGINEER—Age 34. Degree, B.S.M.E. Management ability and character. Able to initiate and carry through all types of manufacturing programs and get results efficiently and economically. Industrial background: Army ordnance equipment, turbo-jet and reciprocating aircraft engines, farm machinery, hydraulic presses, railroad freight and passenger cars, and laminated plastics. Work experience: tool engineer, manufacturing project engineer, project procurement and liaison engineer, methods and procedures analyst, and toolmaker. Location and salary open. Complete resume on request. Write to Box 036, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

PRODUCTION AND INDUSTRIAL ENGINEER—with a university education desires new position in Canada or will relocate. Sixteen years' experience in machine tool development and design, automation and simplification, processing and tool engineering, time and motion study, production technique improvement, production control, plant engineering and cost analysis. Write to Box 037, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

MUSKEGON—Recently installed chapter officers, from left, are: James E. Swineheart, national delegate; Vernon T. Nephew, first vice chairman; Leslie R. Nelson, treasurer; James V. Chvala, second vice chairman; Joseph E. Fernley, secretary; and John R. Baker, chairman.—*James Swineheart*

Dr. W. J. Horvath Speaks at Long Island

Dr. W. J. Horvath, operations research consultant, was the guest speaker at a Mar. 14 meeting of the Long Island chapter. In his presentation, "Operations Research," Dr. Horvath described the principles of a method of analysis of operations that was developed during World War II and is now being applied to many tool engineering problems such as inventory control, equipment maintenance, production scheduling and life table estimations.

On Mar. 5, the chapter held an installations dinner dance at the Garden City Hotel. Two hundred were in attendance. National Director Richard A. Smith installed the officers and Jerome Barfus received the chairman's award for his contribution as editorial chairman.

Honored guests were: Director Smith and his daughter; and Mr. and Mrs. Joseph L. Petz. Mr. Petz is chairman of the National Editorial Committee.

—William H. Bruning

LONG ISLAND—Richard A. Smith, national ASTE director, installed officers of the Long Island chapter at the installation dinner-dance. From left are: George C. Bennett, delegate; Theodore Borecki, secretary; Harold Poett, treasurer; Sara T. Moxley, second vice chairman; John C. Hatter, first vice chairman; George J. McLaughlin, chairman; and Mr. Smith.

R. K. Lee Addresses Tri-Cities Chapter

The technical program for the March meeting of Tri-Cities ASTE members was presented by R. K. Lee, vice president in charge of research and engineering, Alloy Rods Co. His talk was heard by 60 members and guests at a meeting held at the Rock Island Arsenal post cafeteria.

After the installation of officers, committee appointments for the year were announced. They are: Josephy Clancy, membership; R. M. Knabe, Bernard Cardinal, Leo Doering, Clifford C. Vogt, and William Lucas, program; and Don Shewry, public relations and editorial. The service pin was awarded to Mr. Vogt for his work as editorial chairman.

—C. C. Vogt

Portland, Ore., Members Visit Tektronix, Inc.

A tour of the Tektronix, Inc., plant was made Feb. 24 by the Portland, Ore., chapter. About 118 members and guests participated.

The firm, manufacturers of complete cathode-ray oscilloscopes, was established in 1947 and now employs more than 500 persons and has worldwide distribution of its products.

—Walter L. Brenneke

Editor Addresses Muncie Members

Hunter Hughes, editorial director of *Industry and Power* magazine, was the program speaker at the March meeting of Muncie chapter. He talked on the subject "Engineering as a Profession."

Installation of chapter officers, performed by Charles Marker, past chairman, was a high spot of the meeting. Another program item was the showing of colored slides, taken by Don Wedlick, of a recent major fire in the Muncie area.

—Darrell Marks

Frank Zagar Speaker at Kalamazoo Meeting

Frank Zagar, president and general manager of Zagar Tool, Inc., presented a talk on "Jig Design for Multiple Drilling" for the Kalamazoo chapter on Mar. 22.

A howling blizzard and drifted roads prevented many, including the chapter photographer from getting to the meeting.

—T. J. Cook

R. A. Smith Installs Fairfield Officers

National Director Richard A. Smith was a special guest and installing officer for the March meeting of the Fairfield County chapter. Some 125 were on hand to see the officers sworn in.

F. W. Lucht, engineer in the Carboloy Dept. of General Electric Co., was the technical speaker.

—Henry Busby

HENDRICK HUDSON—Pictured at the Mar. 16 meeting are, from left: Macmillan McElwain, chairman; Father Benjamin Kuhn, OFM, Siena College; Robert E. Wagar, Socony-Vacuum; and Malcolm MacKenzie, program chairman.

Houston Holds Executive Night

A crowd of 143 turned out for the Houston chapter's executive night and installation of officers. New officers were installed by Otis Traughber, and Lee Dolan, charter member of the chapter, was the recipient of the year's merit award for over-all service to the chapter. New officers are: J. W. Hindeman, Jr., chairman; John Bailleres, first vice chairman; Paul Langdale, second vice chairman; S. E. Rees, secretary; and Charles Hay, treasurer.

Speakers were Charles H. Elliott, manager Cleco Div. of Reed Roller Bit Co., and William Marvin Hurley, executive vice president and general manager of the Houston Chamber of Commerce. Mr. Elliott spoke on "The Value of ASTE to Management"; and Mr. Hurley addressed the group on "The Industrial Outlook for the Gulf Coast Area." —*George Bo-Linn*

Officer Installation Highlights Ladies' Night

Portland, Me., members held their installation of officers Mar. 11 as part of their annual ladies' night meeting. The new chapter leaders were sworn into office by Howard W. Stevens, past chairman.

Entertainment for the evening included the showing of travel slides by Russell Paulson.

—*Henry C. Hagman*

Rockford Tours Beloit Iron Works

More than 180 members and guests visited the plant of Beloit Iron Works, Beloit, Wis., to study the manufacture of papermaking machinery. The tour was arranged by Henry Anderson.

Howard Nelson, head of the 1954 education committee, awarded the prizes to the winners of the chapter's high school mechanical drawing contest. —*Les Teachout*

R. E. Wagar Speaks at Hendrick Hudson

Robert E. Wagar, field engineer for Socony-Vacuum Oil Co.'s Albany Div., was the guest technical speaker at Hendrick Hudson chapter's Mar. 16 meeting. "Industrial Lubrication with Respect to Cylinders, Bearings and Gears," was his topic.

Coffee speaker was Father Benjamin Kuhn, OFM, of Siena College, who spoke with humorous anecdotes on "Better to Lead than Be Led."

—*Macmillan McElwain*

Ernie Egger, left, receives the distinguished service award from Chairman Mel Burdett for outstanding work on behalf of Louis Joliet chapter

H. Dale Long Installs Louis Joliet Officers

H. Dale Long, now national treasurer of ASTE for 1955-56, installed officers of the Louis Joliet chapter on Mar. 8. Guest technical speaker on the evening program was George Getschell, consulting engineer for McCrosky Tool Corp., who talked on "Precision Manufacturing Past and Present." The meeting was held at the Woodruff Hotel.

—*Harold Zierke*

Mechanical Metal Testing Discussed at Memphis

Illustrated by slides showing various applications, a talk on mechanical metal testing was given March 11 at a meeting of the Memphis chapter. Speaker was V. E. Lysaght, national sales manager, Wilson Mechanical Instrument Division.

Other meeting activities included the installation of officers and presentation of the outstanding member award to Nathan Tamm for his service to the chapter. —*Frank Fly*

MIT to Present Course on Metal-Cutting in June

A special summer session for engineers interested in metal-cutting, lubrication, bearings and wear will again be offered this year by the Department of Mechanical Engineering at Massachusetts Institute of Technology at Cambridge, Mass.

The two-week course will start on June 27 and will present advanced material on metal-cutting and lubrication, using work from previous summer sessions as a foundation. This year's program will also include small group participation in laboratory research experiments.

Full particulars and details can be obtained by writing to Prescott A. Smith, associate professor of mechanical engineering, Massachusetts Institute of Technology, Cambridge 39, Mass.

University Chapter Hears Plastics Talk

The regular Mar. 10 meeting of the Kansas University chapter, attended by 30 members, featured a program on "Reinforced Plastic Tooling." The speaker, Charles E. Chastain, secretary, Magic Circle Tool and Engineering Co., was assisted in his presentation by Philip Fleming, plastic engineer for Bendix Aviation Corp. and program chairman of the Kansas City chapter of the Society of Plastics Engineers.

Mr. Chastain pointed out the importance of wax used to keep the plastic from adhering to the pattern and touched on the uses of plaster molds for plastic tools.

—*Kenneth Crabtree*

TWIN CITIES—Installation of officers was conducted March 2 by H. Dale Long, far right, national director and treasurer of ASTE. From left: Peter S. Tobias, alternate delegate; Jerome W. Schwartz, national delegate; Walter Comstock, treasurer; Arnold Lidfors, secretary; Norman Sorlie, second vice chairman; Philmore W. Armstrong, first vice chairman; and Robert M. Johnson, chairman. Speaker at the meeting was Ray Wilds of Allied Products Corp.—*R. R. Wressell*

LITTLE RHODY—Pictured at the Little Rhody March 3 meeting are: Paul Watelet, first vice chairman; Philip J. Peckham, Jr., chairman; C. G. Schelley, managing director of the Wilkie Foundation; Karl Freidland, secretary; Horace V. Bennett, second vice chairman; and Gilbert Stafford, treasurer.

SAN FERNANDO VALLEY—Chapter officers were installed March 11 by Wayne Ewing, far right, fourth vice president of the Society. From left: Henry T. Young, national delegate; Charles L. Goodspeed, treasurer; John R. Bethune, secretary; Robert C. Broomell, second vice chairman; Alfred T. Rando, first vice chairman; and Keith H. Griffin, chairman.—*A. J. Soares*

SCHENECTADY—Shown in this group picture of chapter officers, from left, are: Fred Kinum, past chairman; John Sheridan, chairman; Frank Corriveaux, first vice chairman; David S. Delack, second vice chairman; Arnold L. Hanson, secretary; and George S. Nelson, treasurer.

BINGHAMTON—David O. Williams, past chairman, installed chapter officers for the coming term at the Mar. 2 meeting. From left are: Past Chairman Williams; Phillip M. Taylor, chairman; Wendell Harper, first vice chairman; Andrew Komar, second vice chairman; Charles L. King, secretary; and Robert Carbrey, treasurer. Elwood Hendricks was awarded the chapter service pin and T. H. Whipple, sales manager for E. H. Titchener, presented a technical program on "Wire Forms."—*Paul J. Adamek*

Little Rhody Meets with ASQC Section

Little Rhody chapter held a joint meeting with the Rhode Island section of American Society for Quality Control on Mar. 3. Some 140 attended the meeting in the Commodore Room of Johnson's Hummocks. Officers were installed by Raymond Morris, past president of ASTE, and Gilbert Stafford received the service award pin for contributing most to the chapter.

The technical program was the widely traveled DoAll exhibit, "Civilization through Tools," presented by C. G. Schelley, managing director of the Wilkie Foundation.

—*Richard Kilbane*

L. B. Bellamy Appointed Manager of Operations

Leslie B. Bellamy, a past president of the Society, has been named general manager of operations of Sterling Grinding Wheel Co., Tiffin, Ohio. Formerly general manager of Sterling Abrasives, he will have executive control of all Tiffin operations. Announcement of Mr. Bellamy's promotion came from Paul B. Brown, president of the company and also of The Peninsular Grinding Wheel Div., Abrasive and Metal Products Co., Detroit, Mich.

New Position

E. R. Wagner of Lima chapter has accepted a position with the Gearing Div. of Westinghouse as supervisor of manufacturing engineering for the newly formed Torque Converter reactivity. He will be responsible for planning the new facility. He has served as chairman of the Lima chapter's professional engineering committee, and was previously with the Small Motor Div. of Westinghouse.

—*Donald Cox*

San Antonio Chapter Installs Officers

March meeting activities for the San Antonio chapter were highlighted by the installation of new chapter officers. The ceremony was witnessed by nearly 150 members and guests.

The technical program was presented by Harry M. Betts, sales engineer for Wessenderf Nelms Co. of Houston. He was introduced by Chairman James A. Metcalf.

—*Stanley G. Gower*

Lehigh Valley Observes Fifth Anniversary

Lehigh Valley chapter celebrated its fifth anniversary on March 18 at the Hotel Traylor in Allentown, Pa. Seventy-five members and guests enjoyed a special dinner and witnessed the cutting of a birthday cake presented by Hotel Traylor's chef. It was bedecked with Roman candles. John Folwell, past chairman, officially installed the new chapter officers.

Guest technical speaker was G. L. Prudhon, supervisor for Western Electric Co. He spoke on electronic devices and more specifically about transistors. *—Chauncey R. Kay*

WINDSOR—These men are instrumental in the success of the chapter's education program to provide additional training for graduates of technical schools and apprenticeship courses. Lectures, given during evening classes, are augmented regularly by plant tours through allied industries. Two courses are offered, one in die design engineering and one in tool design engineering. Standing: C. B. Moncrieff, Gord MacKie, James Challoner, William Augustine. Seated: Douglas Nuttall, Ed Litwin, Michael Hollo, George Harrison and Eric Millin.

Ralph L. Mueller, newly elected chairman, and George Savitz, retiring program chairman, sink a knife into Lehigh Valley chapter's birthday cake. It was the chapter's fifth anniversary.

Chicagoans Hear Two Speakers

Z. C. Schartz of Baldwin-Lima-Hamilton Corp. and H. J. Siekmann of General Electric Co. were the guest speakers at the Mar. 7 meeting of the Chicago chapter. Some 150 members and guests met at Keymen's Club for the program including installation officers. Arthur Schaid was the recipient of the chapter honor award for outstanding service during the past year.

Speaker Schartz gave a talk on the technique of high speed and high cycle milling. Mr. Siekmann presented his company's experiences with the machining to titanium.

—R. C. Berliner

Professional Engineers Build New Headquarters

Excavation work has been started on the site of the new national headquarters building in Washington, D. C., of the National Society of Professional Engineers. Ground was broken Mar. 25 by Clarence T. Shoch of Allentown, Pa., NSPE president.

Mr. Shoch declared the event to be "another milestone in the development of a strong professional engineering society, equipped with the proper housing facilities to perform the necessary tasks for its more than 34,000 members."

The approximately $300,000, four-story, reinforced concrete frame, granite faced building, located at 2029 K Street in the Northwest section of the Capital, will house the NSPE executive and administrative offices, and the offices of the *Americacn Engineer*, monthly magazine published by the Society.

The building project is being financed by the sale of building fund participation certificates to the membership, and the building s expected to be ready for occupancy by January 1, 1956.

HOUSTON—Executive night drew a large crowd for the Houston chapter. Seated are the main speakers, Marvin Hurley of the Chamber of Commerce, and Charles Elliott of Reed Roller Bit Co.'s Cleco Div. Chapter officers are, from left: Otis Traughber; Charles Hay, treasurer; Paul Langdale, second vice chairman; J. W. Hindman, Jr., chairman; John Boilleres, first vice chairman; S. E. Rees, secretary; and Howard Boswell, past chairman.

Automation Discussion Heard at Schenectady

Charles E. Kraus, president of Kraus Design, Inc., Rochester, N. Y., was the program speaker at the March meeting of Schenectady chapter. He spoke on "Automation in Parts Handling Equipment." Slides showing equipment designed by the Kraus firm 'on the job' in industry were used to illustrate the talk. *—George S. Nelson*

coming ASTE meetings

Jack McCarthy, right, presents Hod Holt with the service pin for his outstanding work for ASTE during the past year in the Santa Clara Valley chapter.

On-Campus Conferences

MASSACHUSETTS INSTITUTE OF TECHNOLOGY—May 6, Cambridge, Mass.

UNIVERSITY OF TENNESSEE—May 6, 7, Knoxville, Tenn.

MICHIGAN STATE COLLEGE—May 14, East Lansing, Mich.

Chapter Meetings

ATLANTA—May 16, 6:30 p.m., Manning's, Peachtree St. at 10th.. "Machine Tools and Vibration" by a representative of Consolidated Engineering Corp.

BALTIMORE—May 4, 8 p.m., Engineers Club. "Aluminum Dip Brazing" by Donald E. Wernz, chief metallurgical research, Glenn L. Martin Co.

CEDAR RAPIDS—May 12. Plant tour of Collins Radio Corp., Cedar Rapids, tenatively scheduled.

CENTRAL PENNSYLVANIA—May 4. "Diamond Mining" by a representative of Super Cut, Inc.

CHAUTAUQUA-WARREN—May 19, Warren. "Production Tooling Problems" by representatives of Scully-Jones & Co.

CLEVELAND—May 13. "Wax Lubricants for Metalworking" by R. F. Farley, regional supervisor, Industrial Products Div., S. C. Johnson & Son Co.

COLUMBUS—May 11. "Milling Original Contoured Shapes" by Frank W. Hale of Pratt & Whitney Div. of Niles-Bement-Pond Co.

FOX RIVER VALLEY—May 23, VFW Hall, St. Charles. "Tube Bending" by B. F. Bower, president of Pines Engineering Co., Inc.

GRAND RIVER VALLEY—May 6, 6:30 p.m., Leisure Lodge. Ladies' night dinner-dance.

GRANITE STATE—May 17, 7 p.m., Somersworth, N. H. Hotel. "Tooling and Machine Tools" by E. H. Flook, sales representative, National Automatic Tool Co., Inc.

HAMILTON DISTRICT—May 11. Plant tour.

INDIANAPOLIS—May 5. Father and sons night. Meeting sponsored by Firestone Tire and Rubber Co. Film on the "500-Mile Race."

LEHIGH VALLEY—May 20, 7 p.m., Pottstown, Pa. Plant tour of Doehler-Jarvis Die Casting Co.

LIMA—May 5, 8 p.m. Tour of National Seal Co., Van Wert, Ohio. May 13, 9 p.m., New Royal Pine Room, spring dance. May 19, 6:30 p.m., New Royal Pine Room, speaker D. J. Brown of Mullins Manufacturing Co.

LONDON-ST. THOMAS—May 19. Program by a representative of Canadian Fairbanks Morse Co.

LONG ISLAND—May 9, 5:30 p.m., Combined plant tour and dinner meeting. Tour of Fairchild Camera and Instrument Corp., Syosset, Long Island. Eight o'clock dinner at Wheatley Hills Tavern, Post Ave., Westbury, N. Y. Nine o'clock—speakers from Fairchild explain aerial cameras and procedures of quality control. May 23, 8 p.m., Long Island Agricultural and Technical Institute. Panel discussion "Can Tool Engineers Plan and Prepare Themselves for Future Roles in Management?"

ASTE Industrial Exposition and 24th Annual Meeting will be held March 19 through 23, 1956 at Chicago, Ill. The Exposition will be held at the International Amphitheatre.

LOUIS JOLIET—May 17, 6:30 p.m., Woodruff Hotel. "Proper Perspective on Plastic" by Robert E. Klies of Bakelite Co.

LOUISVILLE—May 10, 6:30 p.m., L&N YMCA. "The Unified Thread System" by B. D. Witmeyer, superintendent, Fixed Gage and Inspection Instrument Div., Sheffield Corp.

NEW HAVEN—May 2. Host to Connecticut Tool Engineers Day.

NORTHERN MASSACHUSETTS—May 17, 7 p.m., Eagles' Hall, Gardner, Mass. "Automatic Screw Machines and Tooling Applications" by W. H. Spence, sales director, Brown & Sharpe Manufacturing Co.

MERRIMACK VALLEY—May 5, 6:30 p.m., The Elms, Manchester, N. H. Automatic modular construction of electrical circuitry, referred to as "Project Tinkertoy," by Sidney K. Tally, associate and assistant head of Special Products Div., Sanders Associates, Inc.

MILWAUKEE—May 12, 6:30 p.m., American Serb Memorial Hall. "Jigs and Fixtures for Hand Welding" by Hans G. Frommer, production manager, Trackson Co. Illustrated by 50 slides.

PHILADELPHIA—May 19, Plant tour.

PIEDMONT—May 18, 8 p.m., Thomasville, N. C. Annual dinner-dance.

PORTLAND ORE.—May 19. Business meeting.

SAGINAW VALLEY—May 19, 7 p.m., Hotel Zehnder, Frankenmuth, Mich. "Nuclear Gaging."

SANTA CLARA VALLEY—May 17. "Induction Heating" by Dr. Harry B. Osborn, Jr., technical director, Tocco Div. of The Ohio Crankshaft Co. and national ASTE president.

SCHENECTADY—May 9, 8 p.m., American Legion Post #21. "Hydraulics as Applied to Industrial Machinery" by J. C. Carpenter, district manager, Vickers, Inc.

SEATTLE—May 24. Tooling research panel. Subject: "What's New in Tooling?" Panel chairman—R. B. Snively.

SOUTHEASTERN MASSACHUSETTS—May 17, 7 p.m., Brockton, Mass. "Tool and Toolroom Grinding" by a representative of Norton Co.

SPRINGFIELD, MASS.—May 9. "Surface Finishing."

TRI-CITIES—May 11, 6:30 p.m., Rock Island Arsenal. Program by representative of Cleveland Twist Drill.

TWIN CITIES—May 4, 6:30 p.m., Hamm's Brewery, St. Paul, Minn., annual smoker.

TWIN STATES—May 10, Hotel Windham, Bellows Falls, Vt. "Civilization through Tools."

WINDSOR—May 9, 6:45 p.m., Prince Edward Hotel, Windsor. "Hydraulic Applications to Machine Tools," by a Riddiford, Jr., chief engineer for John S. Barnes Corp.

Automation Topic at Benton Harbor-St. Joseph

"Automation" was the subject of a talk given at the Benton Harbor-St. Joseph chapter on Mar. 10 at the Berrien Hills Country Club. Speaker was Clifford E. Evanson, president and general manager of Technical and Business Engineering, Inc. Seventy members attended this meeting at which the new chapter officers were installed. —*Orvis L. Johnson and Bernard F. Ladewski*

Madison Chapter Names Officers for 1955-56

Headed by John Piekarski as chairman, a new slate of Madison officers was elected Feb. 17. Chosen were: Len Mueller, first vice chairman; Arnold Griswold, second vice chairman; Chet Frederick, third vice chairman; Arvil Mergen, secretary; Art Collins, treasurer; and Jack Murray, delegate.

The technical program, entitled "Diamond Wheels and Carbide Grinding," was presented by Van Riper, district engineer, and Paul Carlson, district representative for the Norton Co. —*Lyding Havey*

Retiring chairman of the Pittsburgh chapter, Elwood Weissert, presents Paul H. Magnus, II with the chairman's pin at the March 4 meeting.

Ralph Herrod Talks on Oil Mist Applicators

Pittsburgh members and their guests heard a discussion by Ralph Herrod, sales engineer for the Alemite Co. at the chapter's March meeting. Mr. Herrod, with the aid of slide films and two assistant speakers, spoke on oil mist as it is applied to the lubrication or bearings, gears and conveyors. The application as a coolant on cutting tools was also covered. —*E. L. Caughey*

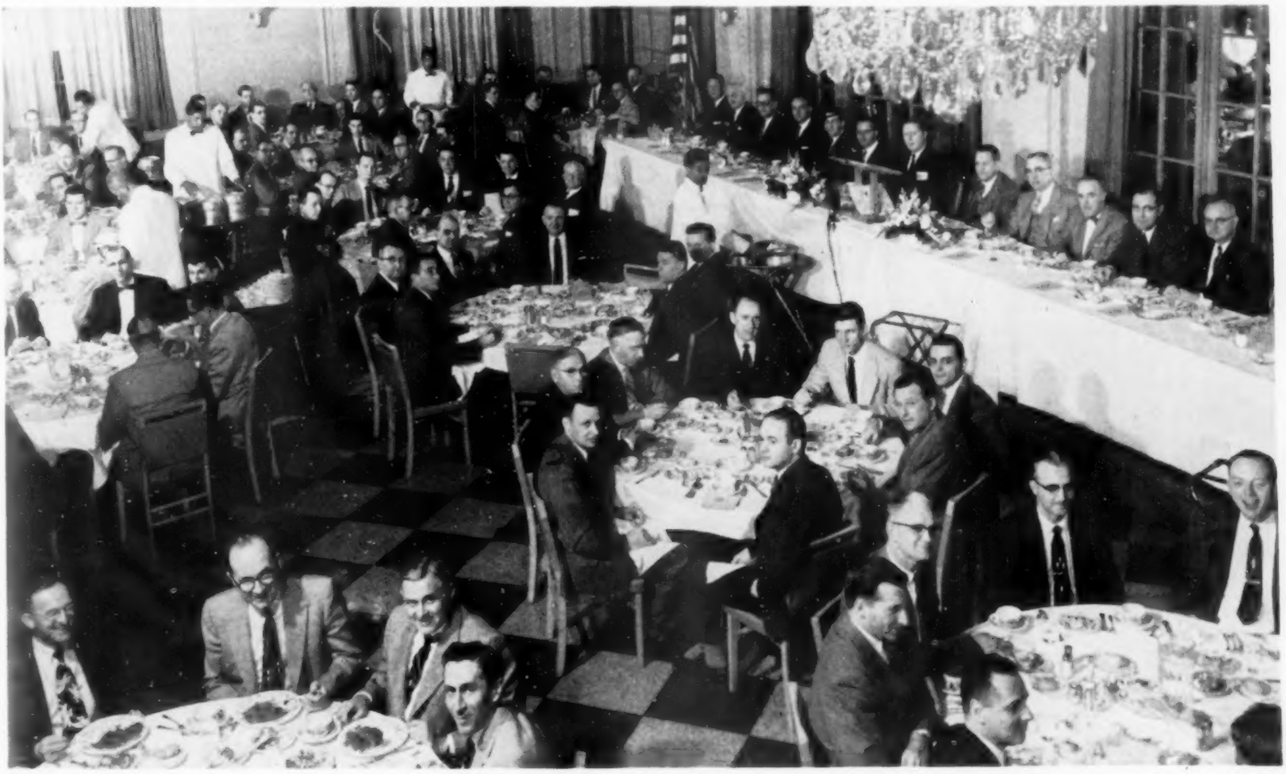
Educator Speaks at Calumet Meeting

George E. Davis, director of adult education, Purdue University, was the guest speaker at the Mar. 7 meeting of the Calumet Area chapter held at the Cape Cod Inn. Mr. Davis discussed two areas which his group is particularly concerned with—community development and the problem of aging. He stated that with the number of people passing the age of 65 every year on the increase, a program for adapting individuals for retirement is greatly needed. He told of such facilities at Purdue.

Thomas C. Barber, chairman of the National Program Committee for 1954-55, was on hand to install the new chapter officers. —*L. W. Montgomery*

Tool Exhibit Shown at Philadelphia Meeting

DoAll Company's well-traveled "Civilization through Tools" exhibit made its Philadelphia stop on Mar. 17 for an ASTE meeting held at the Engineers Club. It was described by C. G. Schelley, managing director of the Wilkie Foundation. —*S. A. Matthews*



CENTRAL PENNSYLVANIA—An attendance of 125 persons was on hand for the annual executives' night meeting held by the Central Pennsylvania chapter. Guests included: Joseph P. Crosby, ASTE president for 1954-55; E. E. Aughenbaugh, plant manager, S. Morgan Smith Co.; C. T. Beaverson, director of research, New York Wire Cloth Co.; John Boyer, president, York Chamber of Commerce; A. C. Allenbrand, plant manager, Caterpillar Tractor Co.; J. K. Louden, vice president, Commercial Div., York Corp.; B. M. Root, Jr., plant manager, B. M. Root Co.; R. K. Serfass, vice president, Industrial Div., York Corp.; W. F. Patterson, plant manager, American Car and Foundry; J. T. Robertson, vice president, York Corrugating Co.; and J. S. Butler, plant manager, American Chain & Cable Co.

MERRIMACK VALLEY—Affiliate membership plaques were presented at the March installation meeting. Company representatives receiving them, front row, from left, were: Ralph Turner, Treet Hardware Co.; John W. Sjostrom, Pope Machinery Corp.; John Lewis, Lowell Iron & Steel Co.; Pope Marion, Edgecombe Steel of New England, Inc. Ralph I. Robbins, national delegate, and William P. Hamblett, past secretary, are shown in back of the recipients. Officers were installed by Director Richard A. Smith.—*Arthur E. Clement*

TWIN STATES—Newly installed officers, from left, are: C. Jenness Cameron, chairman; Harold M. Noyes, first vice chairman; Clifford Howe, second vice chairman; Glenn D. Easton, treasurer; and Donald S. Whitney, secretary. Technical speaker at the March meeting was James Y. Scott, president of Van Norman Co. and Morse Twist Drill Co., who talked on the future of machine tool industry.—*Maurice Blais*

NIAGARA DISTRICT—New chapter officers, seated, are: Harold Crawford, chairman, and Ralph Meacher, first vice chairman. Standing: Henry Litke, secretary; Kenneth Hiscott, treasurer; and Walter Pentesco, second vice chairman.

De Groat and Thornton Named to Book Committee

To help clarify the announcement of appointments to the ASTE National Book Committee which appeared in the April issue of THE TOOL ENGINEER, *the following portion of the article is published as it should have appeared originally:*

Francis J. Sehn, chairman of the National Book Committee, has announced two new appointments to the committee. They are George De Groat, associate editor of American Machinist; and Richard B. Thornton, manager of the machining process department, manufacturing staff of the Ford Motor Co.

Mr. Thornton received his engineering training at Detroit Institute of Technology and Wayne University. He started with the Ford Motor Co. as an apprentice draftsman and later was process engineer and tool design leader on various defense jobs including the B-24 Bomber and T-48 Tank during the war. After the war he was with the production engineering department processing chassis and engine parts. When the overhead valve engine program came into existence in 1950, he was made supervisor of the planning and coordination section, a position which he held until his appointment as manager of the machining process department.

Dr. Osborn Speaks to Hamilton Members

Dr. Harry B. Osborn, Jr., new president of ASTE, was the guest technical speaker and installing officer at the Hamilton District chapter's March 10 meeting.

John Snyder, retiring chairman, presented the service pin to Stan Palmer, a member of the program committee, for his outstanding work during the year.

Dr. Osborn spoke in his capacity as technical director of the Tocco Div. of the Ohio Crankshaft Co. His topic was "Induction Heating and the Tool Engineer." —*G. W. Hawkes*

"Pantograph" is Topic at Niagara District Meeting

A. D. Gunderson, assistant chief engineer at the George Gorton Machine Co., addressed 80 Niagara District chapter members on Mar. 3 on the topic "Pantography and Its Place in Modern Day Production." The color film accompanying the discussion was one of the best technical films seen by the chapter. Rudel Machinery was host for the evening. —*C. R. Mitchell*

Grand River Installs 1955-56 Officers

The 48th regular meeting of the Grand River Valley chapter was installation night. Officers were installed by Dave McCready, past chairman, and Roy Robertson, secretary of the chapter, was given the merit award pin for years of faithful service.

The technical program was a premier showing of the motion picture "Dynamic Balancing." The movie was presented by W. I. Senger, vice president of Gisholt Machine Co., who answered many questions on balancing asked by the members.

—*W. C. Little*

Gadgets Discussed at Long Beach Meeting

"Gadgets" was the subject of a program held for Long Beach chapter's Mar. 9 meeting which was ladies' night. Wayne Ewing, newly-elected fourth vice president of ASTE, installed the new officers.

Guest speaker was Don L. Davis, called "America's Gadget Czar." He geared his discussion for the ladies, concentrating on household gadgets. One hundred attended this meeting at the Lafayette Hotel.

On Feb. 9, the guest technical speaker was Walter K. Deacon, chief engineer, McCulloch Motors, Supercharger Div. Mr. Deacon showed a series of slides on the engineering development and production of the McCulloch supercharger which was followed by an informal discussion period.

—*C. W. Ward*

Roger Waindle Installs Worcester ASTE Officers

Installation officer at Worcester's March meeting was Roger Waindle, past president of the Society. He also made the presentation of the chairman's pin to J. Irving England and the past chairman's pin to Adam T. Kosciusko. The service pin for 1954 was awarded to Franklin M. Angevine for his outstanding work as chairman of the education committee.

New committee chairmen appointed for the year are: Leo P. Tarasov, program; Paul E. Garlock, constitution; Mr. Angevine, education; Harry D. Orr, advertising; Arthur F. Hird, standards; Alden U. Maynard, membership; Ronald H. Meade, editorial; George L. Gersham, arrangements; Robert S. Morrow, publicity; and Charles W. Monigle, professional engineering. Scholarship fund trustees are Roland Ljungquist and John E. Rotchford.

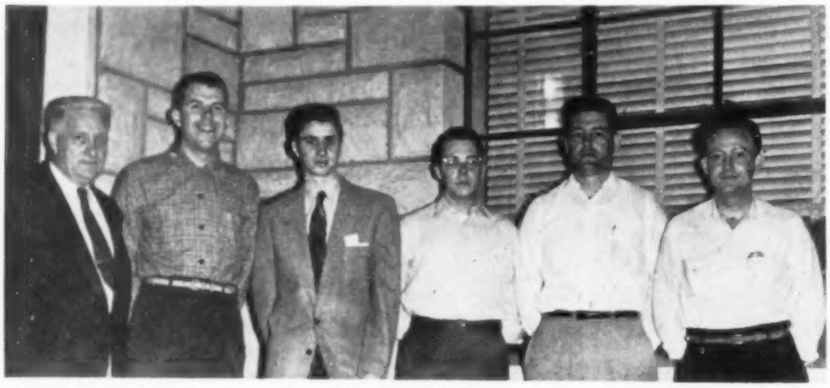
—*John C. Lalor*

GRAND RIVER VALLEY—Shaping the destinies of the Grand River Valley chapter for the coming year is the assignment of this group. In front are: Gilbert Dilly, second vice chairman; Joseph Strite, chairman; and Clayton Henderson, first vice chairman. In the background are: Percy Bowman, third vice chairman; Roy Robertson, secretary; and Grant Johnstone, treasurer.

LONG BEACH—Wayne Ewing, new fourth vice president of ASTE, installs Long Beach officers. From left are: John Stansbury, alternate delegate; Carroll Edson, delegate; Charles Ward, treasurer; James Medford, secretary; Roger Brackney, second vice chairman; Raymond Gariss, first vice chairman; Larry Pomerantz, chairman; and Wayne Ewing.

WORCESTER—Shown at the speakers' table at the March meeting, from left: Daniel W. Hoyt, treasurer; Andrew Peterson, retiring treasurer; J. R. Swanson of Raytheon Mfg. Co.; J. Irving England, chairman; Ralph M. Moschella of Raytheon; Adam T. Kosciusco, retiring chairman; Roger Waindle, past president of ASTE and installation officer; Leo P. Tarasov, first vice chairman; John C. Lalor, secretary; and Cass Karpen, second vice chairman.

GOLDEN GATE—Dr. Lawrence Cook, left, area captain for the National Membership Committee; Ben J. Hazewinkel, ASTE national director; and L. Dean Roulund, right, national delegate, discuss a machining operation at a recent chapter meeting.



KANSAS UNIVERSITY—New Officers of the Kansas University student chapter are, from left: Howard Rust, faculty advisor; Thomas Moore, treasurer; Ronald Hill, secretary; Ralph Engdahl, second vice chairman; Everett Garrett, first vice chairman; and Kenneth Crabtree, chairman.

UNIVERSITY OF MICHIGAN—Newly-elected officers of ASTE's first officially chartered student chapter are: seated, from left, Jay L. Vander Sluis, first vice chairman; and Donald C. Graham, chairman. Standing are: Thomas S. Despres, treasurer; Donald F. Dame, secretary; and John L. VanBecelaere.

C. F. Kaiser Receives Engineers' Week Honors

A member of the Santa Clara Valley chapter of ASTE, Carl F. Kaiser has been named the "Outstanding Tool Engineer in the Bay Area for 1955." Mr. Kaiser, who is assistant professor of production engineering at San Jose State College, was presented with an award scroll by the Bay Area Engineers Week committee at an awards banquet held in February at the St. Francis Hotel, San Francisco.

The banquet, attended by some 350 engineers and their guests, climaxed the observance of National Engineers' Week in the Bay Area.

Selection of Mr. Kaiser, who heads his chapter's education committee, resulted from competition among ASTE chapters in the area which nominated candidates for the honor. He was chosen for his outstanding contribution to tool engineering through his ambitious and successful attempts to bring academic instruction in tool engineering fundamentals, both for students at San Jose State College and for technical employees in industry, to the Santa Clara Valley area through the San Jose College extension service.

George Goodwin Installs Springfield Officers

Installation of officers of the Springfield, Ohio, chapter was conducted Mar. 8 by George Goodwin, national director of ASTE. The ceremony was part of a meeting held at the International Harvester Co.

The technical program, entitled "Tooling with Plastics," was presented by a four-man panel, with Lawrence Drumm, works manager at International Harvester, acting as moderator. Other participants were: George Rice, Ren-ite Tool Co.; Dale Knepp, Kish Industries; and Harvey Parry, Shell Chemical Corp.

—Kenneth W. Keller

Evansville Installs New Chapter Officers

Installation of officers for the coming year and the presentation of the annual chairman's service award, were highlights of the Evansville Mar. 14 meeting. Charles Thuman, member of the National Editorial Committee, installed the officers. Gerald Lykken received the service award from John E. Race, retiring chapter chairman. Ninety-six attended the meeting at Ruthenberg Field.

—William H. Brooks

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. . . a heavier, huskier, hydraulically controlled

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It's Here—At Your Request.
Yes, the tremendous acceptance of Cri-Dan "B" and Cri-Dan "D" has resulted in the development of a larger, heavier precision threading machine greatly extending the range of the Cri-Dan Single Point Threading Method. Not only precision threading but secondary turning, boring, facing and chamfering facilities are incorporated in the Cri-Dan E; complete hydraulic and electric controls assure maximum efficiency even on the heaviest applications. A quick check of the specifications will show the ruggedness and range of this, the newest and finest Cri-Dan Single Point High Speed Threading Machine ever developed. Write The Lees-Bradner Company, Cri-Dan Division for specific information on the processing of your parts.

SPECIFICATIONS

Threading Range	2 TPI-48 TPI	Max. Taper of Thds.	15° Included
Max. Thd. Dia. (Internal)	16" Dia.	Multi-Start Threads	Yes
Max. Thd. Dia. (External)	12" Dia.	Spindle Speeds	50-1400 RPM
Max. Swing Over Ways	25" Dia.	Main Motor	20 H.P.
Max. Swing Over Tool Slide	12" Dia.	Floor Space Req'd	5'6" x 14'0"
Max. Thread Length	6½"	Approx. Weight	4½ Tons
Length Between Centers	2'6", 5'6" & 8'6"		

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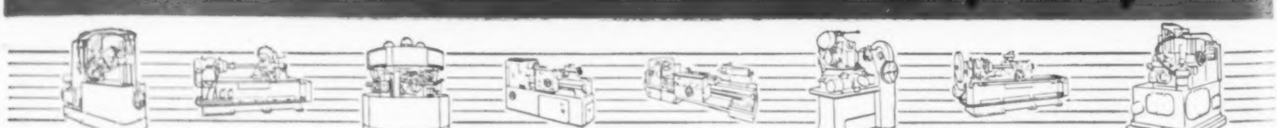

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PROGRESS IN PRODUCTION

DIE CASTING SOARS AS AUTOMOTIVE TECHNIQUE

Breakdown of materials used by the automotive industry shows an impressive increase in the use of zinc-base die castings in the 1955 lines. In this year's models, it was estimated that eight times the weight of zinc die castings were utilized in making front end parts as was used in the 1954 cars. For example, 16 different models have complete die cast grilles, while another half-dozen models have major die cast elements as part of front end treatments.

Besides the fact that zinc producers have cooperated in stabilizing the zinc market, a basic reason for the trend, according to W. J. During, president of the American Die Casting Institute, has been the modern styling demands. Die casting permits both compact appearance and the recessed look to be achieved economically. Complicated and intricate sections can be produced in one piece, minimizing assembly. This uncomplicated production is true not only of grilles but of other pieces such as door handles (which were produced at a rate of almost 700,000 units per day), decorative insigne and moldings, trim elements and instrument panels.

Functional automotive parts are produced economically in high volume both in zinc and aluminum: components of the torque-converter type automatic transmissions are aluminum die castings; carburetor bodies and components are zinc die castings.

According to the die casters' organization, spokesman, reasoning for the abrupt increase in use of die castings is economy plus precision. In this technique, metal goes from raw material to finished part in one step, producing accurately dimensioned, intricate, smooth-surfaced results. Molten metal is forced under pressure into locked metal dies or molds, solidifies to form the die casting, and is ejected from the opened die. The cycle is run rapidly and economically with excellent reproducibility.

GIANT STRETCH FORMER FOR AIRCRAFT WORK

One of the largest stretch-wrap forming machines in the world has been installed at Rohr Aircraft Corp. It was made by Hufford Machine Works.

The Model 60, with its 350 tons of stretching capacity, will produce aircraft components for all air frame manufacturers in the Pacific area.

The machine forms parts from both extruded material and sheets by stretching and simultaneously wrapping the stock around a stationary die. The two large arms are pivoted near the central die location and are wrapped back by means of four huge hydraulic actuating cylinders. Twin barrelled tension cylinders, each exerting 703,720

lb of stretch are mounted on the arms.

Size of the Model 60 machine can be visualized by the following figures. The unit measures approximately 60 feet across the face, stands almost 20 feet high. A pit 7 feet deep in which the machine is assembled was necessary to bring the die area to floor level. Sheet parts can be formed from stock measuring 31½ feet long by 6 feet wide. A single man, who views the entire forming operation from the control panel, operates the machine.

DEVELOP COOLANT WITHOUT FOUL ODOR

Offensive odors which have been an undesirable characteristic of used coolants have been eliminated through a solution reached by the Johnson's Wax Co. researchers who have been working on this problem.

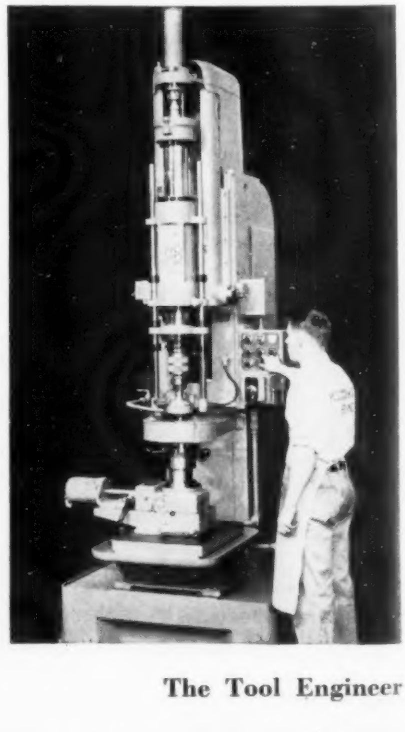
Foul smelling coolant has reduced worker efficiency besides eating up considerable number of man hours due to the frequent need for cleaning coolant tanks. Cause for the odor is bacterial growth that takes place in the tanks, and is particularly noticeable following weekends when plant inactivity leaves the tanks unused and unaerated permitting hydrogen sulphide gas given off by the bacteria to collect. Adding bactericides to the coolant is an impractical solution since, if it is used in sufficient quantity to be effective, the bactericide becomes irritating to workers and creates other complicated problems.

The new water soluble cutting fluid called TL-131, does not require use of formaldehyde or bactericides before it is placed in a machine. Bacteria cannot breed in it since the fluid contains neither fats nor vegetable matter. During the past year of extensive field testing, the fluid proved itself serviceable for as long as two months in warm weather without turning sour.

SPLINE HONING GEARS

Hardened gears are spline honed so the bearing surfaces of the splines are generated concentric with the pitch of the teeth with a finish that will not pick up and gall the shaft on an adaptation of Micromatic Hone Corp.'s Model 728 Hydrohoner.

Problem, previous to the use of this adaptation, was the difficulty of fitting shafts to the gears in 0.0002-in. increments. It was necessary to anneal their surfaces before final machining operation, with a resultant soft bearing surface that tended to pick and gall the shaft. With Microhoning, surface hardness was immaterial, and the problem changed to one of proper tool actuation in the confined area. This was significant because, unless heat-treatment is carefully controlled, the hole may be



out-of-round and tapered as much as 0.006 in. when it reaches the honing operation.

To remove this amount of stock and correct inaccuracies, the cutting path of the abrasive grit must be varied and the stones dressed an equal amount. To hone splines, tools are designed with a stone for each spline. The stone, about half as wide as the spline, is swept across the spline as the tool is reciprocated. The part is indexed periodically during the honing cycle.

In this operation, the adapted unit processes forged steel, 58 to 60 Rockwell C. It removes 0.002 to 0.006 in. stock on diameter, holding out-of-roundness and taper to less than 0.0003 in. Finish is 15 to 20 microinches rms. Size is held so shafts can be fitted easily with 0.0002-in. minimum clearance. Cycle time is 35 to 40 seconds per gear, which turns out 350 to 450 gears per 8-hour shift.

PRECISION CLAMPING IMPROVES PRODUCTION

Production problems growing out of manual clamping of castings on a finish grinding job operation have been overcome by installation of a powered vise for the work at Hills-McCanna Co. With manual vises, too tight a setting damaged the castings; too loose a setting permitted castings to slip during grinding.

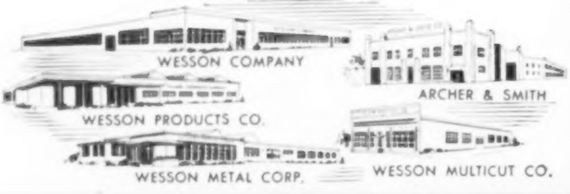
An air-powered hydraulic vise made by the Wilton Tool Mfg. Co., was installed for the job. It has a booster that multiplies air pressure and converts it into hydraulic gripping force. The operator can preset the vise to an exact pressure to hold castings firmly, without damaging the metal. Further, the operator can turn workpieces in the vise quickly and easily, by controlling the jaws with the foot pedal, and moving the casting with his free hand. Results have been a 10 percent reduction in clamping time, easier, less fatiguing working conditions and the end of slippage and metal damage problems.

HARDWARE FINISH ON ALUMINUM AS CAST

Production research has found a way to create a hardware class of finish on aluminum die castings as they come from the die. As a result of this work that has been carried on at Aluminum Co. of America, many new markets are expected to open up for die cast aluminum parts. As an immediate factor, they are acceptable without additional processing for finishing, and therefore will be more attractive to designers of automotive hardware, appliances and builders' hardware.

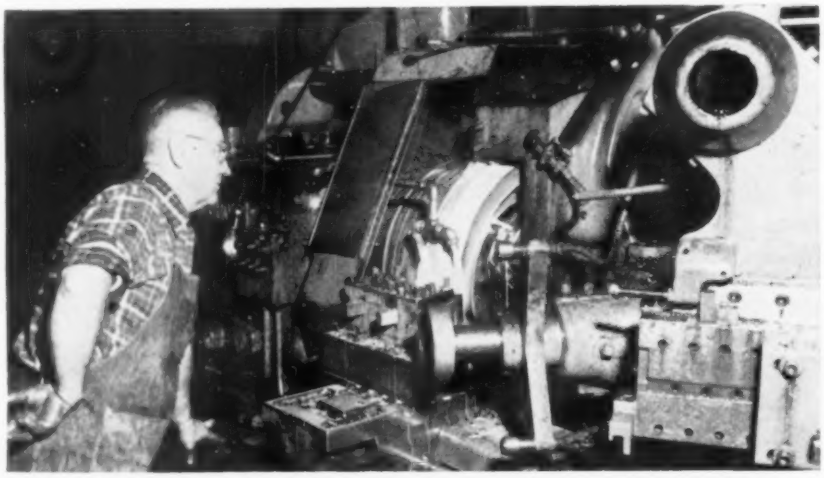
Previously, aluminum die castings had to be finished through expensive operations before they were chrome plated. Now, as a result of production and processes advanced by Alcoa, which gives the parts an improved initial finish, they can be plated with little more effort than for zinc.

With the improved as-cast finishes, plated aluminum die castings appear satisfactory from standpoints of service, weathering and corrosion.

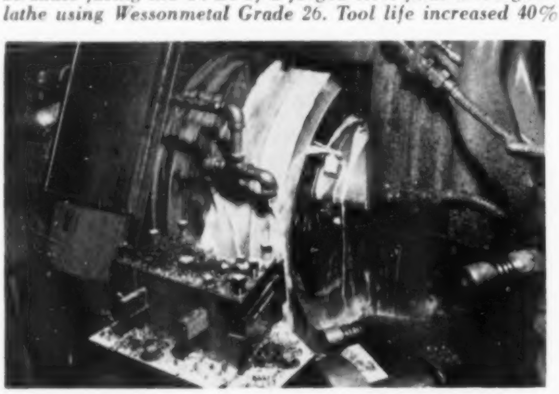


carbide NEWS

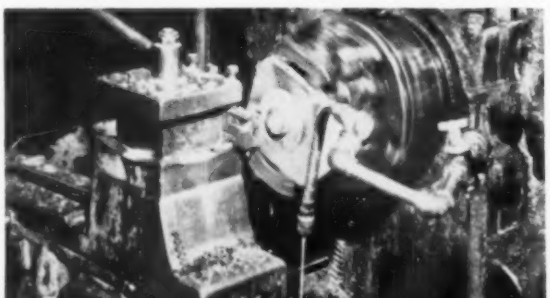
New Grade 26 Nearly Universal



Straddle facing the O. D. of a forged steel final drive gear on a 4F Gisholt Fastermatic lathe using Wessonmetal Grade 26. Tool life increased 40% over other carbides.



◀ *Closeup of straddle facing operation. Two solid carbide Grade 26 inserts are used. Job is being done at 260 sfm and 40 rpm. Feed varies from .017" to .020" with average depth of cut from 3/16" to ¼".*



◀ *Grade 26 produced a 30% increase in tool life on a severe interrupted cut on a tractor brake band anchor. Standard Wesson band-type Multicut is used on a Warner & Swasey turret lathe. Cutting speed ranges from 280 sfm down to zero. Feed is .027", depth of cut is ⅛".*

tools Wesson
carbide Wessonmetal

Useable on 95% of steel cutting operations, it boosts tool life 40%

The nearest approach to a universal cutting grade available to the metalworking industry is a new carbide designated as "Grade 26" by Wesson Metal Corporation. Created primarily for all types of steel rough and semi-finish machining, it is also proving highly effective on some finishing operations.

Problems of carbide selection are greatly simplified by Wessonmetal Grade 26, since it cuts down the number of grades required for steel cutting operations by as many as four grades.

Optimum performance for Grade 26 extends over a range of 100 to about 400 sfm, covering 95% of steel machining operations encountered in industry today.

Much of Grade 26's record of outperforming all other steel cutting grades in 95% of all machining operations on which it has been applied is due to its superior edge cutting strength. Grade 26 was developed to have high red hardness and high thermal conductivity in order to function without any drop in performance at the elevated temperatures generated at high cutting speeds.

Improvement in tool life over all other grades has averaged about 40% on applications to date. Extensive tests have been conducted on a wide range of materials ranging from conventional steels to the high alloys used in high temperature applications.

Now in full production at Wesson Metal Corporation's new metals plants in Lexington, Ky., Grade 26 provides the answer to lower tool costs over a broad range of metal cutting operations.

For answers to your machining problems write:
WESSON COMPANY
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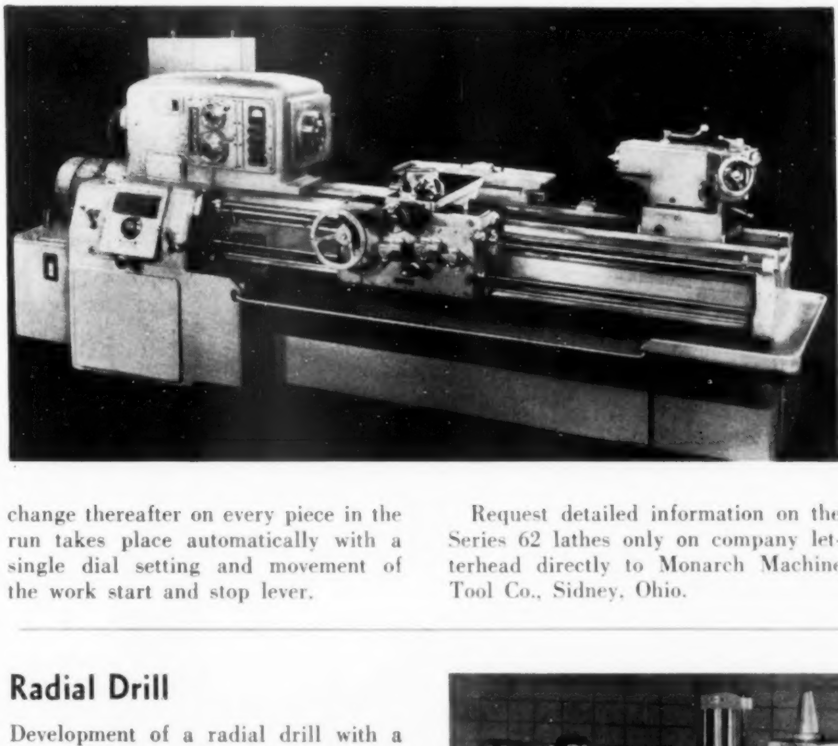
TOOLS of today

Lathe with Preselection Device



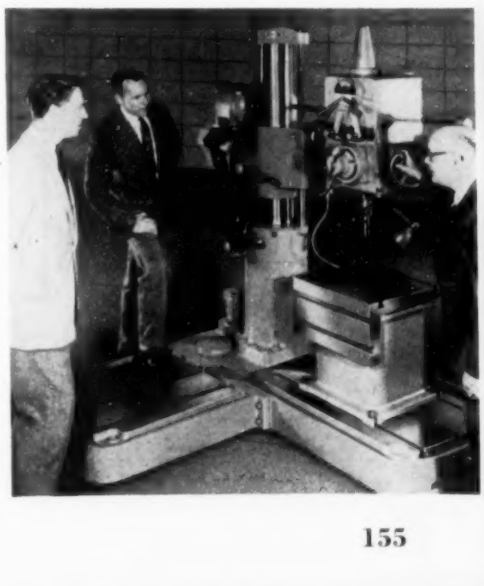
Monarch Machine Tool Co. has announced a new Series 62 Preselector Dyna-Shift lathes which incorporates both the Dyna-Shift headstock, which was introduced earlier in the Series 90 heavy-duty lathe, plus speed preselection to provide additional economy in over-all machining time.

The Series 62 is offered in four models: Model 130 swings 13 in. over the cross slide, has a clearance diameter of 20 in.; Model 131 swings 16 in. over the cross slide and has a clearance diameter of 24 in.; Models 1130 and 1131 are provided with more accessory equipment for broader flexibility for toolroom work. Thirty-six spindle speeds are provided in these units, ranging from 14 to 1750 rpm. Among design features are the high pressure mist system lubrication of all headstock gears and bearings; the multiple V-belt drive to the headstock; and the 4-way power rapid traverse for rapid tool positioning, quick tool retraction and fast carriage return.

Controls of the preselector Dyna-Shift consist of a surface speed setting dial, work diameter setting dial, diameter preselectors, spindle rpm indicator dial and a knob which frees the spindle from the gear train. Operator merely sets the dials for work diameter and surface feet per minute required; the equipment computes the rpm and makes the shift automatically and hydraulically to give correct spindle speed for operation. Surface speed may be maintained on succeeding diameters of the work by setting up values of the latter on the work diameter selectors of the preselector control. Every speed change thereafter on every piece in the run takes place automatically with a single dial setting and movement of the work start and stop lever.

Request detailed information on the Series 62 lathes only on company letterhead directly to Monarch Machine Tool Co., Sidney, Ohio.

Radial Drill



Development of a radial drill with a flame-hardened column has been revealed by Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio.

The column of the new unit, which has been trademarked Hardclad, is engineered to provide a thick-walled, centrifugal casting.

The radial drill features two-lever, direct-reading, color-match, spindle speed and feed shift dials. The No. 3 Morse taper spindle is provided with nine spindle speeds and six power feeds. All controls are grouped within easy reach of the operator, including the start-stop pushbuttons.

The entire internal mechanism is

forced-spray lubricated by an oil pump.

The $1\frac{1}{2}$ hp main drive motor is mounted on the arm to the left of the column, providing counterbalance and easy accessibility. Power is transmitted through a silent chain and drive shaft, and no parts of the main drive arrangement are concealed in the head.

Numerous safeguards for the operator have been designed into the machine to protect him during operation. Among these is the electrical panel built into the back of the arm and a safety switch on the access door to prevent exposing a live panel.

The raise-lower pushbuttons are covered by a guard, preventing vertical movement of the arm until the barrel clamp is released.

The new radial is a 3-foot arm $7\frac{1}{2}$-inch column machine with a drilling capacity of $1\frac{1}{2}$ inches in cast iron, and it drills to the center of a 77-inch diameter circle.

Catalog D-133 containing full details about the machines, is available from the manufacturer. **T-5-1561**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Screw Machine

Single spindle, bar automatic screw machine, the Detroit Screwmatic 750, has been introduced by Gear Grinding Machine Co., 3901 Christopher, Detroit 11, Mich.

Designed to obtain maximum workability from modern tools, the unit ma-

chines all types of bar stock up to 0.750 OD and provides lowered cost, high production of short, medium and long parts of every degree of precision and complexity.

Design of the machine incorporates several important features. Heavy section cross slides and direct cam activation assure close tolerances. A six-position turret is provided for end working tools. Slideable turret unit, which increases work length capacity, may be positioned away from the spindle without crowding toward tools. A three-position crank permits long, medium and short work to be produced with equal efficiency.

Sufficient speeds are available to machine all types of materials with carbide tools. Spindle speeds are infinitely variable and three different forward speeds may be employed during any cycle of work. All speeds are reversible.

In operation, work chips flow into a large chip well with an open end. High walls of the well provide oil splash protection. **T-5-1562**

Portable Welder

The Generator Sales Co., 1627 North Damen Ave., Chicago 47, Ill., has a portable welder that has the capacity of big industrial units, yet is light and compact enough to be carried about by means of a convenient carrying handle.

Dimensions of the Deluxe Model 2BW make it require floor space of only 13 x 16 inches and is slightly less than 11 inches in height.

Its specifications are: Amperage out-

put 15 to 140; open circuit voltage, 40; input, 110-220 volts, a-c or d-c; line draw, 24 amperes on each of two 110 volt circuits, or 24 amperes on a 220 volt single phase; also may be used on two circuits of a 3-phase line. It has straight or reverse polarity; operates at 7500 rpm. Amperes of continuous duty are 15 to 100; amperes of 50-percent duty are 15 to 140. It has 12 welding controls. Welding horsepower is 3.6. **T-5-1571**

Automatic Cycle Chamfering Machine

Chamfering hypoid pinions without requiring a skilled operator may be accomplished with the single-station Model BM-2148 Burr-Master, designed by Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 38, Mich. Production rate is more than 250 pinions per hour per machine, and one operator can handle two machines.

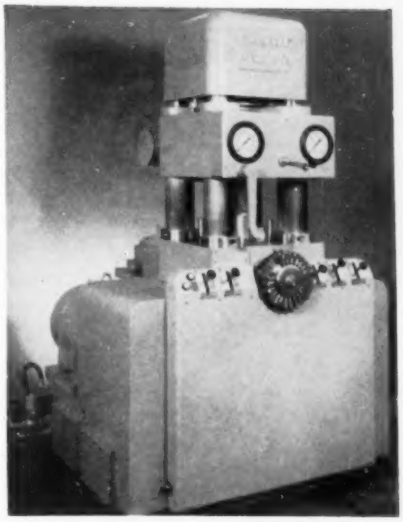
The pushbutton actuated machining cycle is automatic with the Burr-Master coming to a stop with cutting tools retracted when the cut is completed. Since the Burr-Master generates the chamfer uniformly, it leaves no sharp corners well into the root of the tooth.

Two pushbuttons, located for operator safety on opposite sides of the machine, start the machining cycle. Machining time is 5 seconds and floor-to-floor time is 13 seconds.

An indicator light on the front of the machine illuminates at the start of the machining cycle and goes off when the machine stops at the completion of the cycle. A foot pedal is used to eject the finished parts. A safety interlock prevents ejection of the part if the foot pedal is depressed accidentally while the machine is running.

Changing over from one pinion to another is quick and simple. **T-5-1572**

Metal-Forming Machine



The Cincinnati 8-inch Hydroform has been introduced by the Process Machinery Div., The Cincinnati Milling Machine Co., Cincinnati 9, Ohio for fast and economical production of a variety of small size, deep-drawn and formed parts.

Hydroforming embodies use of a male punch, and a flexible die member backed up by hydraulic oil pressure which may be accurately controlled up to 15,000 psi.

This 8-inch machine will form parts from sheet metal blanks up to 8 inches in diameter with a maximum draw depth of 5 inches. Most sheet metals in gages up to ¼-inch steel can be drawn. The maximum machine oper-

ating rate is 200 cycles per hour.

The machine is self contained, floor mounted, 5 x 5 x 7½ feet high, weighs 12,000 lb and requires only water and electrical connections for operation.

Larger units are offered in the 12, 19, 23, 26 and 32 inch capacities. Complete information for the entire range of sizes is contained in the manufacturer's publication No. M-1759-3.

T-5-1581

Plug-Snap Thread Gage

A simple device for checking internal threads has been developed by The Johnson Gage Co., 534 Cottage Grove Rd., Bloomfield, Conn. This plug-snap device, made both as a nonindicating gage and as an indicating comparator, will check to 0.0001 tolerances, and is adjustable for oversize or

undersize threads. It is made up in all the National or Unified Screw Thread Tolerances.

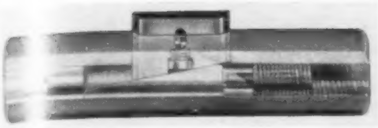
Set to a master setting ring thread gage, it may be used either as a hand or as a bench type tool for both production and inspection checking. Easy to handle, it is fast, accurate and durable, and is constructed to provide full length support of all gaging elements. This rigidity permits it to be made also in the instrument and small stud size threads. **T-5-1582**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Spindle Key

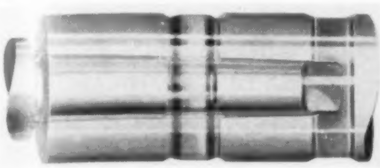
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., has announced the Adjustable Draw Key, a simple, sure mechanism for locking Morse taper shank tools quickly and securely in machine spindles with one easy wrench adjustment.

The device consists of but three sturdy, trouble-free moving parts—expanding wedge, plunger and adjusting nut. It is available in a couplete range of sizes to fit most machines with spindle diameters from 3 through 8 in., and



Above. Partial cutaway view shows the draw key's simple mechanism.

Below. Draw key is in place, locking a tool shank securely in a spindle.



draw key slots from 33/64 x $1\frac{1}{8}$ in. through 11/16 x $1\frac{3}{8}$ in. A wide range of wedge adjustment in the Adjustable Draw Key design accommodates variations in shank and spindle slot location.

The key offers speed in use—it is only necessary to insert the tool shank in the spindle, drop the Adjustable Draw Key into spindle and shank slots and turn up the adjusting nut with an Allen wrench to expand the key's wedge. Steady pressure of the expanding wedge seats the tool shank securely in the spindle, locking it there until the adjusting nut is reversed. To remove the key, merely loosen the adjusting nut, relieving wedge pressure, which allows draw key to drop out.

When in place during use, the key is entirely inside the spindle slot, and within the spindle's outside diameter. Standard Adjustable Draw Keys can be obtained from Davis dealers, and special keys can be produced for any machine spindle. **T-5-1591**

Tool Grinder

An improved #3 Tangent-Arc Profile tool grinder, designed to reduce setup time to a minimum and to grind a wide variety of cutters accurately and efficiently has been announced by Union Twist Drill Co., Athol, Mass.

The tool will grind convex cutters, full half circle up to $2\frac{1}{2}$-inch radius; 120-degree arc up to 4-inch radius;

concave cutters 0 to 5-inch radii.

It also is suitable for arbor cutters up to 10-inch diameter and 5-inch face; shank cutters held by shank maximum sizes 10-inch diameter; #11 B&S tapershank 5-inch length of cut; shank cutters held by centers; 4¾-inch diameter, 5-inch length of cut and 10-inch over-all length of cutter.

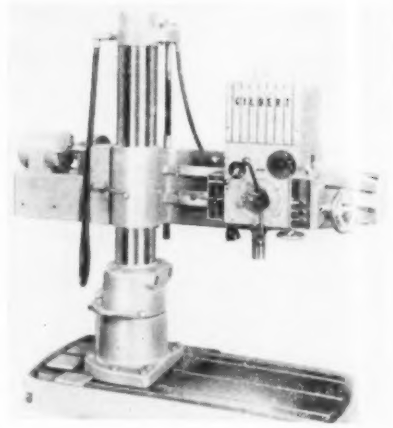
Clearances may be ground on straight or spiral teeth at 0 to 90 degrees from cutter axis up to 5-inch length of cut.

Profiles composed of any combination of circular arcs and angles may also be ground. **T-5-1601**

Drill Unit

Cincinnati Gilbert Machine Tool Co., Cincinnati 23, Ohio, has developed a 3 hp light-duty radial drilling machine that offers three spindle speed ranges: 40-1600, 50-2000, and 80-3200. Twelve geared spindle speed changes are provided in the head by means of sliding gears mounted on integral multiple splined shafts. The machine is equipped with an automatic reverse to spindle.

The standard feed mechanism has four feeds: 0.003, 0.007, 0.011 and 0.015 ipr.



The head is mounted on the arm on two-dove tail slides which require no adjustable gibs because the weight of the head is carried on adjustable ball-bearing rollers which operate on a hardened and ground way.

As a safety feature, it is impossible to raise or lower the arm while it is clamped; centralizing the lever clamps the arm securely to the column. The arm movement stops automatically when it reaches either the top or bottom of the column. It also stops automatically if any part of the head or arm should hit an obstruction when the arm is being lowered.

A wide variety of bases, including runway or rail mountings, is available.

The machine is built with 3 or 4-foot arms and 9-inch column. **T-5-1602**

Chart Layout Board

A chart layout board featuring an integral T-sine square unit has been introduced by the Optical Gaging Products, Inc., 26 Forbes St., Rochester, N. Y.

Primarily, it offers a method for producing chart-gages for contour projectors and comparators. The 21-inch square aluminum board is accurately

jig bored for locating pins over which the T-square and T-sine square can be located. Gage blocks can be located between the T-square, and the locating pins to form angles to maximum accuracy.

Magnification scales fitted in the locating edges of the board permit drawing directly to scale. A selection of OGF glass and plastic blanks is supplied with the unit. **T-5-1611**

Platform Truck

Lift Trucks, Inc., Cincinnati 14, Ohio, has announced their "K" Hydro-electric hand-motorized, high-life platform truck.

Feature of the unit is its mast assembly which is telescopic with roller type construction having lifts of 60, 108, and 120 inches. The platform is 7 inches lowered height minimum; 24 and 26 inches wide. Lengths are from 36 to 60 inches. The truck is made in 2000 and 3000-lb capacities. **T-5-1612**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tool Kits

Doit Urslf precision tool kits are available from S. J. Williams Precision Tool Kits, Inc., 4448 Soo Line Lane, Schiller Park, Ill.

The kit contains materials and unfinished pieces needed by toolmaker, machinist, student or apprentice who wants to make his own tools.

Certain tools in the line are designed specifically for the use of manufac-

turers and machine shops to reduce costs in grinding operations.

There are 14 tools immediately available. These include the following kits: toolmaker's vise, magnetic parallels (in a variety of lengths, laminations and kinds of laminations); magnetic V blocks (also in a variety of lengths and laminations); 5-inch sine block and V blocks and clamps. Eventually there will be over 20 tools in the line.

The materials used in all of the current tools have been tested for the use to which the tools will be put.

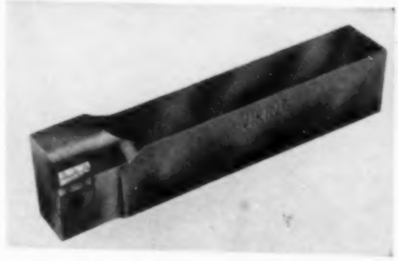
Each kit contains all materials necessary to completing the tool plus easy-to-follow drawings. **T-5-1613**

Cutting Tool

A single point cutting tool employing a wafer-type, indexable throwaway carbide insert is being made by The Viking Tool Co., Shelton, Conn.

Main feature of the tool is its No-Grind inserts with either positive or negative rakes. These inserts are indexed to the unused cutting edge after each edge is worn. Negative rake inserts may be indexed on both sides.

Tool design incorporates an adjustable, mechanical chip control block,



which locks with the top surface of the insert, metal to metal, to avoid galling or wedging of the chip. Another fea-

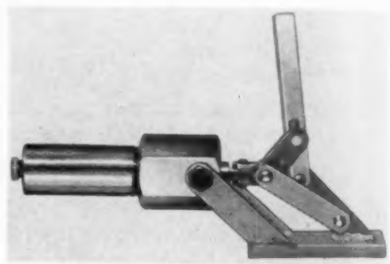
ture is a hardened, replaceable anvil which absorbs shock, such as damage caused by carbide fracture. Besides protecting the tool, the anvil's close-up support permits use of thin, inexpensive carbide inserts. Three adjustable mechanical elements are included in the new holder, giving it unusual versatility.

Bulletin #54 gives complete details concerning the tool. **T-5-1621**

Toggle Clamp

Development of a Triple-E air or oil-operated toggle clamp has been announced by E & E Engineering, Inc., 15023 Harper Ave., Detroit 24, Mich.

Air or oil power to replace hand clamping gives the tool fast action. It



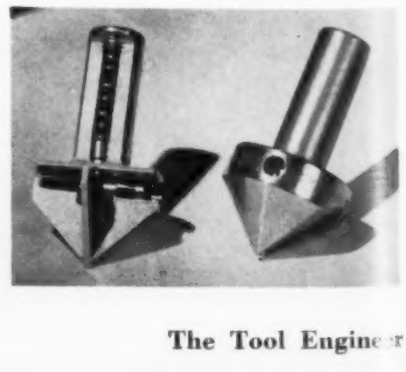
can be used any place where manual clamping is employed, either individually or in multiples. Both cylinder and clamp come as an integral unit.

The Triple-E power clamp is of simple, compact, sturdy design to give long-life operation, with minimum maintenance requirements. Hardened bushings are used at the pivot points. The clamp is made from cold-rolled stock and is not stamped. The cylinder is completely noncorrosive.

Stroke of the tool is 3 in., and bore cylinder is $1\frac{1}{2}$ in. **T-5-1622**

Deburring Tool

A deburring tool that operates without chatter in any conventional drill press, is announced by Randles and Reynolds Machine Co., Alpena, Mich. The tool, which may be used in any



machine that is capable of rotating the tool, at the surface speeds recommended by the high-speed steel manufacturers for the material being machined, is used for holes ⅛ to 1 in. in diameter in any machinable material. It may also be used as a hand deburring tool for many applications.

Basic principle involved is a controlled feed or thickness of the chip being removed. It is obtained by regulating the protrusion of the cutter blade beyond the body of the tool, with an adjusting screw projecting through a hole in the cutter blade; that is in turn crosswise of the body of the tool.

T-5-1631

Counterbores

Carbide-tipped counterbores, Series 600, for the quick, precise cutting of nonferrous metals are available from The Nelco Tool Co., Manchester, Conn.

The carbide tip of these tools ends

less than 0.015 inch from the pilot hole, allowing the use of pilots only 1/32 inch larger than the pilot hole, assuring an accurate, clean cut to exceptionally close tolerances. A hole running completely through the tool facilitates removal of pilot.

A special grade of carbide is available if counterbore is to be used on steel. Length and diameter of pilots furnished to sizes standard in the cutting tool industry. **T-5-1632**

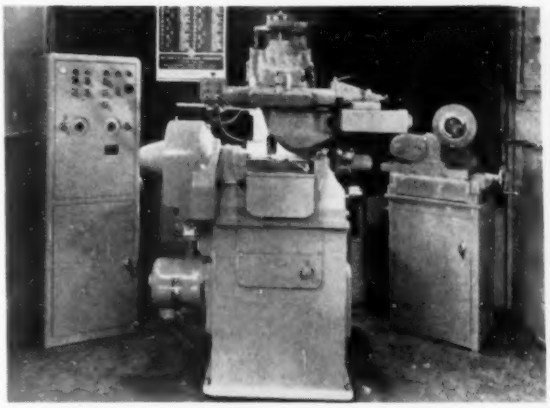
Heavy-Duty Ball Bearing

Thomson Industries, Inc., Manhasset, N. Y., announces production of a large-size linear ball bearing, called a ball bushing, for use on 3-inch diameter shafts.

Availability of this new large size offers advantages of this type of bearing for machine tools, special machinery, and heavy equipment where linear motion is a consideration.

A prime advantage is that their linear freedom is not dependent on the presence of an exposed oil film, and inaccuracies due to variations in oil film thickness and condition do not have to be considered. **T-5-1633**

Precision Spur and Helical Gear Grinder



Belock Instrument Corp., College Point, New York, N. Y., has introduced a fully automatic precision gear grinder for spur and helical gears that represents a new approach to this work. Relatively inexpensive for this kind of equipment, the generating type gear grinder is simple to set up and operate.

Although it is a high production machine, it was so designed as to make short-run jobs economically feasible. In addition, it offers features that will enable smaller gear shops to enter the gear grinding field.

A major feature is the built-in tooling, which does away with need for expensive tooling. A special involute dial is set to the proper index number to pro-

duce the proper involute shape for the particular size gear to be ground. Three change gears are selected for the number of teeth on the gear and the proper dressing cam is inserted in the diamond dresser.

A complete setup can be accomplished in 60 minutes or less. **T-5-1641**

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Bar Feed Unit

Feedall, Inc., Willoughby, Ohio, has placed on the market a bar feeder, Model 1700 B, that feeds bars and tubes automatically to other equipment such as polishing machines or heat-treating equipment.

The model illustrated will convey parts $\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter and 6 to 26 inches in length at any desired, constant speed of 5 to 20 fpm from the

hopper to the machine. Other models are available up to 60-inch length that work at various rates of feed.

Cycling control of this unit can be either photoelectric relay or mercury switch. Parts can be delivered either as illustrated or at right angles by use of special tooling. **T-5-1642**

Collet Adapter for Eccentrics

Economy 5C face plate collet adapter, designed by the Eco Engineering Co., 12 New York Ave., Newark, N. J., trues work with absolute accuracy and enables rapid setups for turning eccen-

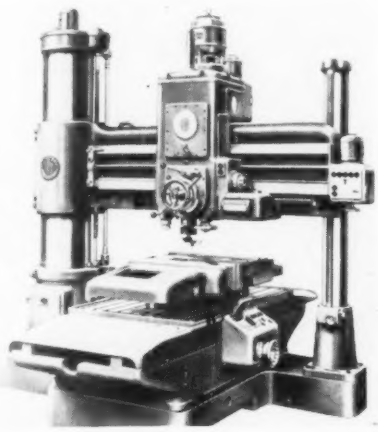
trics with either new or old equipment. This versatile, low-cost collet adapter permits standardization on 5C collets for precise offset setups for milling machines as well as lathes. It also provides a bigger range of collet sizes without the need to rebore spindles.

The unit is designed to run independent to the spindle and can be indicated to any position, including dead true, regardless of error in collet itself. It is available in capacities up to 1 inch.

T-5-1643

Jig Borer

Positioning a workpiece to within 0.000125 inch takes only a few seconds on the Kolb jig borer made by Leitz of Germany. Speed of the unit is due to traverse with adjustable stops. Convenient pushbutton control permits selection of 18 feeds and 36 speeds. Electrohydraulic clamping is shock-free and



distortion-free, with a result that reading accuracy equals positioning accuracy. Signal lights indicate if head and table are clamped or unclamped. The machine may be used for drilling, boring, reaming, tapping and milling, as well as precision measuring.

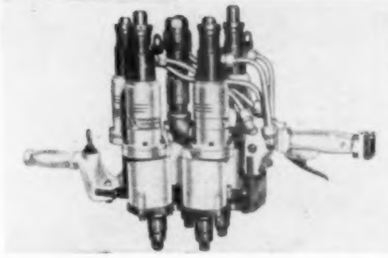
Optical system has a magnification of 1:100. Working surface of table is 69x39 inches; clearance between columns, 73 inches; maximum distance between spindle and table, 40 inches. A bulletin covering more details is available from its national representatives, Cosa Corp., Chrysler Bldg., New York 17, N. Y. **T-5-1651**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Motors for Multiple Nut Setter

Several new motor sizes and styles for their multiple nut setting tools have been announced by Keller Tool Division of Gardner-Denver, Grand Haven, Mich. These additions bring increased flexibility to tools; they can set more closely grouped nuts and bolts than before, and all torque requirements from 4 ft-lb to 190 ft-lb can be met.

The nut setter can be used to run from one to 10 or more nuts or bolts simultaneously, and each can be set to the same or a different torque. Each motor spindle has an integral torque



regulator that can be adjusted easily over the entire range of the motor, and the high accuracy of the regulator permits the torque to be held within very close limits.

The nut setter is designed for ready convertibility through standardization of components.

There are 28 motor sizes and styles. **T-5-1652**

Internal Grinder

The Grind-A-Matic, an air-driven precision grinding head having a planetary action, has been introduced by Perfex Gage and Tool Co., 123 Avery St., Mt. Clemens, Mich. Mounted as a tool in a jig bore, boring mill, lathe, drill press or other comparable machine tool, it offers several advantages characteristic of the more expensive jig grinder. Fine adjustment of radial feed can be made without interrupting spindle rotation.

Fine adjustments in increments of 0.0001 through a range of 0.084 inch is made by rotating a graduated collar which is spring-loaded to eliminate backlash. After setting, the collar position is locked. Coarse adjustment from 0.084 to $1\frac{1}{2}$-inch grinding radius is made with the spindle stationary. Thus,

with standard equipment, holes from $\frac{1}{8}$ to $2\frac{1}{2}$-inch diameter may be ground. With an auxiliary mounting arm the range is increased to 4 inches.

Two interchangeable spindles are available, one developing speeds up to 12,000 rpm, the other having a maximum speed of 75,000 rpm. Speed is infinitely variable with both spindles throughout their respective ranges.

Adapters or arbors are available for any standard machine spindle and are thread-connected to the spindle head.

T-5-1661

Bench Brake

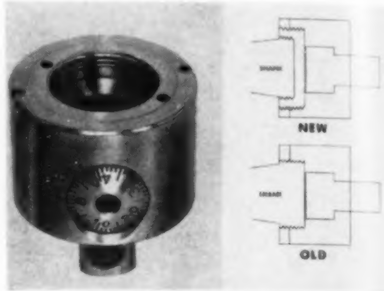
W. Whitney Stueck, Inc., Old Saybrook, Conn., announce their Model U322 universal bench brake. This low cost brake is particularly fitted to accurate short-run production and experimental work as well as plain or box and pan jobs that would tie up

larger, more expensive equipment. The machine is also portable for on-the-job setup.

Rated capacity of the Model U322 is a $\frac{3}{8}$ flange on 22 gage mild steel, full 3 ft length. Fingers of case hardened steel in widths of 2, 3 and 4 inches allow box depths to 3 inches. Design features include replaceable bronze bushings, easy adjustments and simple operation. **T-5-1662**

Offset Boring Head

Flynn Mfg. Co., 133 Flowerdale Ave., Ferndale 20, Mich., announces a major change in their former number 6 and 7 micrometer offset boring heads. The new design provides for permanent pre-loading of the tool block. A cup-type backplate is screwed into the head at the factory, applying proper pressure



on the tool block and is locked in position by a locking ring. The shank turns into the threaded backplate and may be changed at any time without disturbing the load on the block.

Simplified interchange of shanks makes it possible for shops to order heads only. The new heads will be designated as 6-B and 7-B and will use Flynn 150 series shanks and arbors.

T-5-1663

Temperature Meter

A portable temperature meter with an unusually wide range, from −50 to +1000 F, is announced by Webber Cage Co., 12912 Triskett Rd., Cleveland 11, Ohio.

Identified as the Temp-Check Model 386H, it speeds up precision measurements where temperatures in extreme ranges must be immediately ascertained. The meter, which operates on a flashlight battery, is fitted with a sensitive thermocouple and measures temperatures of metals, liquids and air quickly. A quick calculation from the Temp-Check reading tells exact dimensions. **T-5-1664**

Work and Head Positioner

Positioning both the weldment and the automatic welding head may be accomplished with the versatile unit developed by C. B. Herrick Mfg. Corp., 2000 Center St., Cleveland, Ohio. With the Mast-Ram-Positioner (Model CB MRP), work may be positioned or rotated under the welding head which is adjustable vertically and horizontally. Motorized, variable speed, lateral travel on the ram is available with the automatic head mounted on a travel

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Literature Number	COMPANY	DESCRIPTION
A-5-172	Acme Industrial Company	**Dowel Pins**—Dowel pin folder gives OD and length sizes, heat-treat and specifications and other information. (Page 172)
A-5-184	American Broach & Machine Co.	**Broaches and Broaching Machinery**—Catalog contains typical broaching applications, design data, standard keyway broach chart and other data. (Page 184)
A-5-13	American Drill Bushing Co.	**Drill Bushings**—Catalog shows complete line of American Drill Bushings. (Page 13)
A-5-12	The American Tool Works Co.	**Radial Drilling Machines**—Bulletin 327 gives all the facts concerning American Hole Wizard Radial. (Page 12)
A-5-187	Barnes Drill Co.	**Honing Tools and Abrasives**—Catalog 500G points out the types and advantages of BarnesDril tools. (Page 187)
A-5-189	Edward Blake Co. Div. Blake-Waindle Corp.	**Tap Grinders**—Two booklets discuss the Blake Tapsaver grinders for grinding flutes and chamfers. (Page 189)
A-5-223	Boston Gear Works	**Gear Reductors and Ratiomotors**—New catalog R-56 gives complete information, selection charts and engineering data. (Page 223)
A-5-15	Brush Electronics Co.	**Surface Indicator Instrument**—Booklet describes how new ASA Standard B46 operates and the advantages derived from it. (Page 15)
A-5-203-1	Cardinal Machine Co.	**Machine Vises**—Economy advantages of Speed Vise are discussed in bulletin 30-AM. (Page 203)
A-5-178-1	Case-Maul Mfg. Co.	**Toggle Clamps**—Catalog B-12 describes the types of clamps and their applications. (Page 178)
A-5-294-1	Cerro de Pasco Corp.	**Alloys**—Bulletin A1 gives the solution for many anchoring by magnetism problems. (Page 294)
A-5-33	The Cincinnati Shaper Co.	**Press Brakes**—Sizes and types of press brakes are discussed in catalog B-4. (Pages 32-33)
A-5-238	The Cleveland Crane & Engineering Co.	**Bending Presses**—Illustrated catalog 2010 gives construction and engineering details of steelweld bending presses. (Page 238)
A-5-219	Consolidated Machine Tool Co. Modern Tool Works Division	**Solid, Adjustable Taps**—Bulletin M-130 gives full information on Modern MS solid taps. (Page 219)
A-5-252-2	Detroit Stamping Co.	**Portable Clamps**—Bulletin 482-4-6 gives details of De-Sta-Co adjustable clamps. (Page 252)
A-5-158-2	The Eastern Machine Screw Corp.	**Thread Chasers**—"Selecting the Proper Die Head for the Job" discusses insert chasers for automatics. (Page 158)
A-5-265	Eastman Kodak Co.	**Contour Projector**—Information on how to use projection gaging is contained in "Kodak Contour Projectors." (Page 265)
A-5-234	Erickson Tool Co.	**Holding Tools**—Catalog K gives applications for all Erickson holding tools. (Page 234)
A-5-293	Federal Products Corp.	**Air Gages**—Catalog 54D tells the whole story of Dimensionair gages and accessories. (Page 293)
A-5-156	The Gaertner Scientific Corp.	**Toolmakers' Microscope**—Bulletin 147-50 gives features and accessories for the Gaertner microscope. (Page 156)
A-5-64	George Gorton Machine Co.	**Rotary Duplicator**—General catalog 1655-2605 describes the advantages of the four-spindle rotary duplicator and additional Gorton tools. (Page 64)
A-5-165	Greaves Machine Tool Co.	**Milling Machines**—"How Does Greaves Compare in Price and Performance" is available on request. (Page 165)
A-5-269	Hannifin Corp.	**Air and Hydraulic Cylinders**—Bulletin 113 Series H discusses hydraulic cylinders and Bulletin 213 Series A describes air cylinders. (Page 269)
A-5-IFC	Heald Machine Co.	**Automatic Loaders and Chuckers**—Model 170 automatic loading chuck type internal is described in Bulletin 2-170-1. (Inside Front Cover)
A-5-198	The B. Jahn Mfg. Co.	**Progressive Dies**—Coverage of Jahn dies is given in "Story of B. Jahn Dies." (Page 198)
A-5-270-1	Jergens Division Donley Products, Inc.	**Live Bushings**—Catalog describes Jergens bushings and how they eliminate maintenance costs. (Page 270)

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A-5-226-2	Kaufman Mfg. Co.	**Tapping Machines**—Catalogs 754 and 1153 discuss advantages of Kaufman tapping machines. (Page 226)
A-5-246	Lepel High Frequency Laboratories, Inc.	**Induction Heating Units**—New 36-page illustrated catalog contains information on high frequency induction heating. (Page 246)
A-5-210	The Lincoln Electric Co.	**Automatic Welding Machines**—Cost-reducing features of Lincolnweld's automatic welders are told of in bulletin 439. (Page 210)
A-5-276-2	F. J. Littell Machine Co.	**Stock feeding and Straightening Machines**—Catalog 6-U gives full details of Littell machines. (Page 276)
A-5-169-1	The Maxwell Co.	**Boring Tools**—E-Z set boring tools are discussed in catalog. (Page 169)
A-5-294-2	McDonough Mfg. Co.	**Tool and Cutter Grinder**—Sterling Model RK-2 grinder is described in illustrated bulletin RK-2. (Page 294)
A-5-48	Metal Carbides Corp.	**Carbide Tools and Material**—The variety of Talide materials is described in Catalog 55-G. (Page 48)
A-5-206	Mettler Machine Tool, Inc.	**Wire Straightening and Cutter Machines**—Variable speed drive Shuster 1AV machines are discussed in Bulletin 53. (Page 206)
A-5-21	Michigan Tool Co.	**Gear Producing Machinery**—Bulletin RF-54 discusses machines for rolling helical, taper or straight gears. (Page 21)
A-5-59	Niagara Machine & Tool Works	**Straight Side Presses**—Illustrated bulletin 64-H previews a new line of straight side presses. (Pages 58-59)
A-5-193	Oakite Products Co., Inc.	**Organic Finishing**—Illustrated booklet tells how cleaner-stripper-deruster offers possibilities for savings. (Page 193)
A-5-251	The Ohio Crankshaft Co.	**Induction Hardening Equipment**—"Typical Results of Tocco Induction and Heat Treating" is available on request. (Page 251)
A-5-263	Ortman-Miller Machine Co.	**Air and Hydraulic Cylinders**—Catalog and complete set of ½-scale templates show all cylinders, mounts and mounting brackets. (Page 263)
A-5-182	The Parker Stamp Works, Inc.	**Marking Machines**—Automatic hydra-pneumatic machines for marking round or flat surfaces are discussed in catalogs. (Page 182)
A-5-160	Ring Punch & Die Co.	**Punches & Dies**—New catalog 104 gives the shapes, sizes and prices of punches and dies and discusses other products. (Page 160)
A-5-177	Seibert & Son, Inc.	**Multiple Drill Spindles**—Folio 1-50 illustrates and describes the complete line of Seibert spindles. (Page 177)
A-5-259	The Sheffield Corp.	**Thread Rollers**—Bulletin MU-PR454 gives complete information for Precision-Rol. (Page 259)
A-5-295	Simonds Abrasive Co.	**Grinding Wheels**—Book contains stock list and consumer net prices for Simonds grinding wheels. (Page 295)
A-5-202	Standard Parts Co.	**Jig and Fixture Components**—Sixty-six-page catalog describes Noble & Stanton standard jig & fixture components. (Page 202)
A-5-38	The Staples Tool Co.	**Carbide-Tipped Cutting Tools**—Staples standard tool catalog presents their entire line of carbide circular tools. (Page 38)
A-5-29	Sundstrand Machine Tool Co.	**Production Mills**—"Milling Production" gives facts about milling production. (Pages 28-29)
A-5-266	Super Tool Co.	**Carbide-Tipped Tools**—Catalog No. 55 describes complete Super Tool line and gives prices. (Page 266)
A-5-278	U. S. Tool Co., Inc.	**Press Feeds**—Bulletin 15-T contains complete specifications for U.S. Multi-slide machines. (Page 278)
A-5-200	Vascoloy-Ramet Corp.	**Toolholders**—New catalog VR-435B describes V-R toolholders and gives prices. (Page 200)
A-5-205	Waldes Kohinoor, Inc.	**Grooving Tools**—New 20-page technical manual discusses advantages of Tru-Arc grooving tools. (Page 205)
A-5-271	Wales-Strippit Corp.	**Special Fabricating Machine**—Colored, illustrated catalog 10-AA fully describes Wales-Strippit machine. (Page 271)
A-5-260	The Yoder Co.	**Slitters**—Revised 4th edition of Slitter book contains production records, time studies and other data in determining advantages for users. (Page 260)

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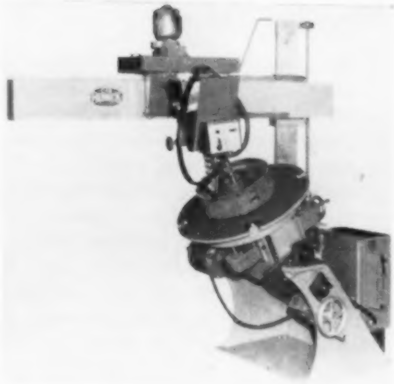


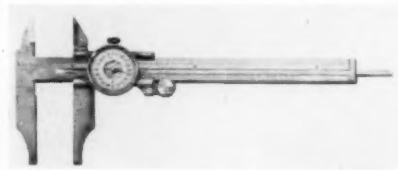
carriage.

Mast and ram can be rotated 360 degrees. The automatic head can be swung around to work on another positioner, turning rolls, bench or floor job.

The positioner shown is rated at 500-lb capacity but other sizes are available. Over-all height is 78 inches; carriage travel on ram is 3 feet. **T-5-1691**

Vernier Caliper

Inspection Devices Co. has announced a dial indicating vernier caliper which reads in thousandths of an inch. It has a full 6-inch measuring



capacity, and can also be used as a depth gage.

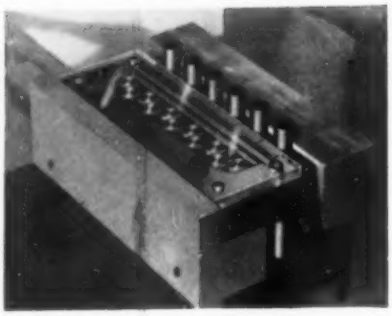
With the caliper, unskilled help may correctly read a vernier by making use of an incorporated dial indicator.

Prices and illustrated brochure are available from the maker, 5636 Lake Park Ave., Chicago 37, Ill. **T-5-1692**

Multiple Clamp

A device that clamps up to 10 parts at once by automatically compensating for size differences, is announced by Design Aids Co., 130 N. 7th St., Newark 7, N. J. This compensating equalizer provides a definite mechanical lock for parts that are hard or soft, regular or irregular in contour. It can be applied to all types of vises, and can be used as a component part of jigs and fixtures.

The unit is available in three types: one for multiple clamping of hard-metal parts, a second for soft material, and a third that will compensate for draft angle and surface irregularities on cast-

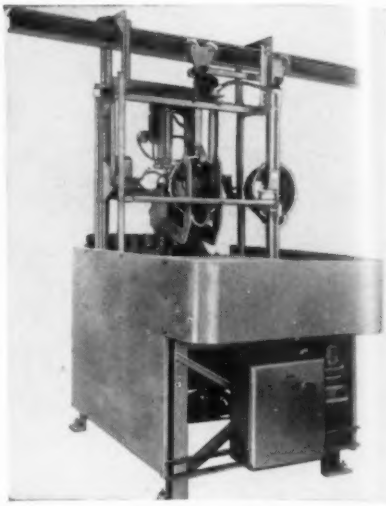


ing and forgings. Many sizes are available in each type. Number of jaws range from 10 to 5, jaw widths from $\frac{3}{8}$ to $1\frac{1}{2}$ inches. Working parts are close-fitting to prevent chips from entering the unit. **T-5-1701**

Transfer Unit

The conveyor transfer machine illustrated removes parts from the hooks of an overhead monorail conveyor and transfers them to a roller conveyor at a rate of 300 pieces per hour. The machine also can be arranged to select certain parts and reject all others from a conveyor which is carrying different parts. It can be adapted to pick up parts from a roller conveyor and place them on overhead monorail hooks or it can be arranged to pick up parts from either a roller conveyor or a monorail conveyor and place them in a machine.

Although the unit is particularly adaptable to round parts similar to those shown, it can be arranged to



handle parts of other shapes, or to take baskets and boxes.

This conveyor transfer machine is manufactured by the General Tool Co., Landy Lane, Reading 15, Ohio.

T-5-1702

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Portable Pipe Machine

A complete portable pipe and bolt threading machine has been placed on the market by The Oster Mfg. Co., Cleveland, Ohio.

This unit, the No. 552 Pipe Master, will ream, thread and cut off all sizes of pipe from $\frac{1}{8}$ to 2 inches and will drive geared die stocks and cutters up to 12 inches, through a special drive shaft.

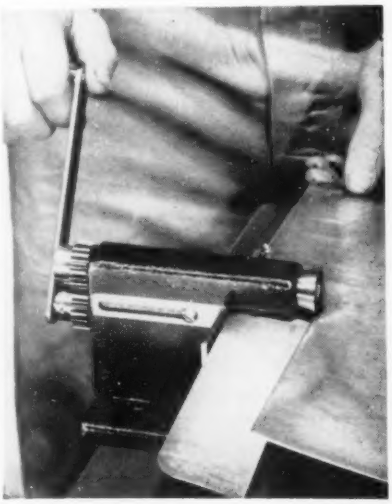
The machine, which is $39\frac{1}{2}$ inches long, $17\frac{1}{2}$ inches wide and $17\frac{1}{4}$ inches high, weighs 265 lb.

It is powered by a $\frac{1}{2}$-hp universal,

geared-head variable speed motor. Spindle speeds are automatically variable with load—22 to 36. Equipment includes a floating-type, adjustable die head and a wrenchless front chuck.
T-5-1711

Small Rotary Shear

Fidelity Tool Supply, Inc., 309 Vine St., Camden, N. J., has introduced a low-cost, hand-operated, rotary shear called the Toolmaster. The tool provides sufficient mechanical advantage to cut steel (other than stainless) as

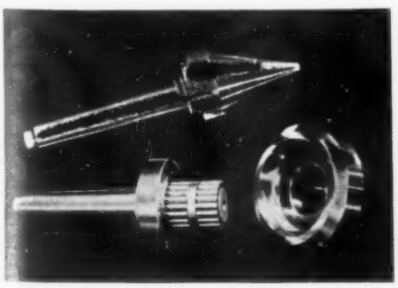


heavy as 16 gage, and will handle heavier gages of aluminum or brass. Among advantages claimed for these hand shears are that they provide a clean, straight cut, and have a positive adjustment for width of cut—from 2-inch maximum down to a trim as fine as 0.005 inch. The Toolmaster can be bolted to a bench or truck. **T-5-1712**

Heavy-Duty Live Center

Close coupled design, independent bearings and wide range of use characterize the heavy-duty live center developed by Trurol Bearing Co., 842 Mandana Blvd., Oakland 10, Calif.

The #4 and #5 Morse taper centers shown have a 4¼-inch diameter hard-



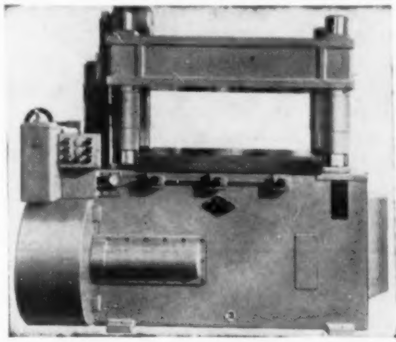
ened cone that applies the cutting load to a preloaded radial bearing of unusual load carrying ability. Thrust is taken independently on a ball thrust bearing of the angular contact type. The combination of bearings is rated at 40 hp at 300 ft on a 2-in. shaft with an ample safety factor.

The bull center shown is for tubing having a hole from 1-inch minimum to 4-inch maximum. A shaft center also is made in this design and has a spring loaded thrust bearing with a 1/16-inch travel to take care of the shafting heat. Bearing overload protection is provided.

Commercial centers are made with a total runout not exceeding 0.001. Precision centers are furnished with a total runout not exceeding 0.0002. **T-5-1713**

Production Press

A 100-ton production press, announced by Alpha Press and Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich., is only 7 feet high and occupies 75 x 84 inches of floor space. The



press is equipped with a four-speed operating control mechanism permitting a choice of 40, 50, 60 or 80 strokes per minute.

Bed area and clearance are especially large in relation to the tonnage. There is complete clearance between the posts from front to back and right to left. The drive mechanism is housed in the base and pulls the head down, avoiding overhead thrust and assuring alignment by both punch and die.

Safety features are the two hand-operated safety pushbutton controls and one emergency stop button. **T-5-1721**

Dial Gage

C. E. Johansson Gage Co., 10641 Haggerty, Dearborn 1, Mich., announces the Mikrokator No. 500-502 for precise dimensional measurements to an accuracy of $\pm$ 1 percent over the range scale. This instrument is provided with a mechanical, frictionless amplification device without sliding bearings or gears and there is no play, wear or binding.

Three different designs of the instrument are made, in both inch and millimeter, while extra accessories for attachment of the instrument, one fixed and one adjustable back, are available. Irrespective of the adjustable back being used, the zero-setting of the instrument is facilitated with a zero-setting device. If the measuring point is too short, it can be exchanged for longer points without affecting the stability of the instrument.

Two adjustable tolerance pointers which are easily mounted and removed are provided with the gage. **T-5-1722**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

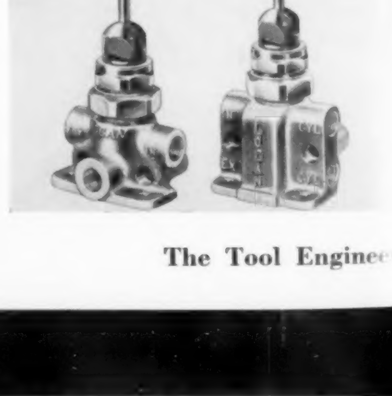
Air Control Valves

Logansport Machine Co., Inc., Logansport, Ind., announces three new $\frac{1}{4}$-in. port, air control valves with locking toggles. All three are designed for side or base mounting.

Model 6664 is designed for control of bleeder and pilot-operated master valve. Removing plug in center port makes 2-way valve into 3-way valve. Operated by hand, the valve will lock in the off-center position and is released manually to vertical (off) position.

Dual control 2-way Model 6665 differs from Model 6664 in that it has two exhaust openings which permit bleeding both ends of master valve alternately to provide automatic reversal when desirable.

Model 6676, a 4-way, 2-position

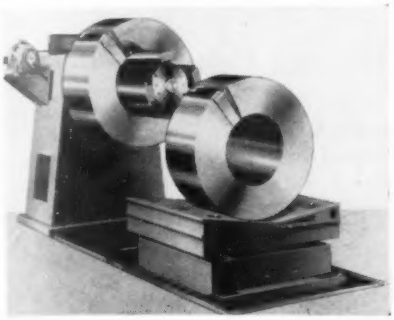


valve is designed for manual control of double-acting air cylinders. It will lock at off-center position to maintain position of cylinder at end of stroke, while a manual or automatic release to vertical position reverses cylinder movement.

Locking position of any of the valves may be rotated 360 deg. **T-5-1731**

Coil Lift

Combination coil lift and a decoiling reel for handling coils up to 40,000 lb has been developed by Dahlstrom Machine Works, Inc., 4225 W. Belmont Ave., Chicago 41, Ill. The coil lift is available with mechanical or hydraulic



elevation, while traverse action is by either electric or hydraulic drive. It can be pit or floor mounted, for in-line or right-angle travel with coil reserve saddle mounted or as illustrated.

The decoiling reel is furnished free-running or motorized for constant drive or for threading only. Tension to prevent overrunning is produced by a drag-type brake.

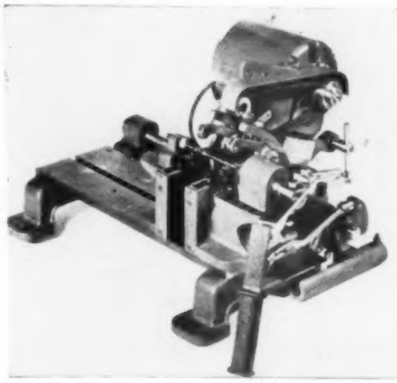
These units are available as a combination or individually and are designed to meet particular requirements of each job, by Dahlstrom Machine Works. **T-5-1732**

Centering Machine

A compact bench-mounted centering machine that holds round workpiece concentricity to within 0.0003 inch, and accurately maintains drill center depth tolerances of 0.002 inch, has been developed by the Central Engineering Co., 930 Erie St., Racine, Wis.

This portable machine tool centers, drills, spot-faces, chamfers and pin-points round workpieces of any length up to 1 inch in diameter. There is no distortion of ends. It minimizes tool breakage by rotating workpiece up to speeds of 15,000 rpm while tool remains stationary. External diameter of workpiece is finished before centering or drilling the ends.

The tool offers speed—producing centers up to a rate of 800 per hour—



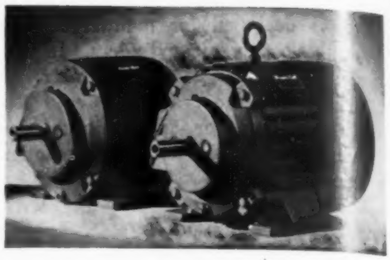
and is easy and fast to set up. It is also simple to operate and inexperienced employees can be taught to perform every operation satisfactorily in a relatively short time. **T-5-1733**

A-C Motors

Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio, has developed a line of totally protected a-c motors.

Regardless of mounting positions, they offer complete protection against drip, splash, and falling objects. Ventilation louvers are positioned high in the end brackets. The frame extends beyond the coil heads to give full protection to the windings, an especially important feature when end brackets are removed. Compact, strong brackets give shockproof shaft support by placing the bearing mountings closer to the frame. Frames are solid cast, and plastic sleeves protect brazed coil head connections.

Neoprene gaskets afford a positive

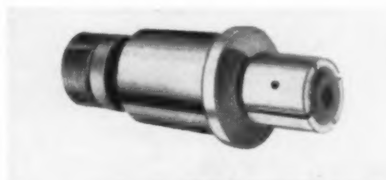


seal between the frame and conduit box and these gaskets have indexed "pressure knobs" to securely hold each lead. Conduit boxes can be positioned in any of the four quadrants for ease of installation.

The enclosed group of motors include three designs: fan-cooled, corrosion proof and explosion proof. **T-5-1741**

Internal Collet

The Ross "Master" internal collet, made by Velocity Engineering, Div. of Morris and Batchelor, Inc., 555 Arden,

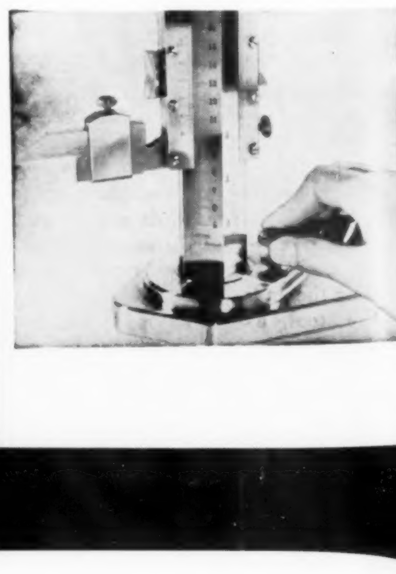


Glendale 3, Calif., is a multipurpose tool for accurate internal holding. Made for use on and with machines and collet attachments, the collet may be applied to lathe spindle grinder spindles and collet indexing fixtures.

T-5-1742

Height Gage

The Chesterman height gage, which uses a triangular scale beam for excellent strength and rigidity, has been introduced by George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. New feature in the design is the sliding head which moves through its entire range by the action of the full-length, large diameter screw in rear of the



bea… The engaging nut is split and is …engaged for quick approximate sett… of the head. Another important …dvantage is the location of the fine …djustment screw in the base. In mak…g adjustments, the downward pre…ure on the screw helps to hold the gag… even more firmly to the surface pla…

The vernier is 2.450 inches long and is …djustable. Accuracy of the setting may be checked by use of a master gage block furnished with each height gage.

Available sizes are 12, 18, 24, 40 and 48 inches; priced from $120 for the 12-inch size to $585 for the 48-inch size.

T-5-1751

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Air Valve

Mead Specialties Co. has developed a 300 series of four-way $\frac{1}{4}$-inch valves in which the same basic assembly can be used as a spring return hand valve, a spring return foot valve, self-locking bench valve, a spring return cam valve and a solenoid-actuated valve.

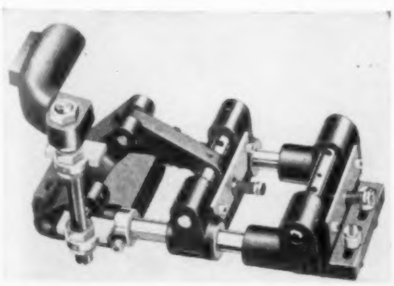
Prime features of the series are their simple, sturdy construction, dependable performance, long life, easy maintenance and parts replacement plus interchangeability of actuating levers.

The valves also have built-in speed control. By regulating the size of the exhaust openings, speed of a double-acting cylinder is easily controlled in both directions.

Bulletin No. SV-74 covering details of the valves, is available from the company, Dept. SV-74, 4114 N. Knox Ave., Chicago 41, Ill. **T-5-1752**

Automatic Feed

An automatic hitch feed to handle maximum stock widths of 3 in. has been introduced by The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. Design of the unit, called Surefeed, is calculated to provide long, trouble-free performance. Adjustable feed gripper plates can be



reversed to give longer life.

The Surefeed can be mounted on the die set without press or feed alterations so that the two units can be handled as one.

Direct feeding action of the Surefeed makes possible a relatively high degree of accuracy; however, pilots and other positioning means should be used where stock register must be exact.

Stock thicknesses of 0.005 to 0.055 inch can be handled. Feed length for presses having 1-inch stroke is 0.000 to ⅞ inch; for presses having 1½ inch or more strokes, 0.000 to 3 inches.

T-5-1761

Tap Extension

The Ritmar tap extension for difficult machining operations has been designed by the Ritmar Corp., 183 New York Ave., Huntington, L. I., N. Y., to facilitate tapping operations with regular taps where access is limited.

The extension is proportioned to hold a single size of tap. Maximum diameter of the extension, or the OD of the collar which applies the clamping action on the tap, is not more than twice the diameter of the tap shank.

A square hole inside the tap-holding end of the extension transmits the

necessary driving torque to the square end of the tap, and gives positive tapping and retracting action with either right or left-hand threads. Worn or broken taps are easily replaced without the use of tools. Taps may be replaced without removing the extension from the tapping machine.

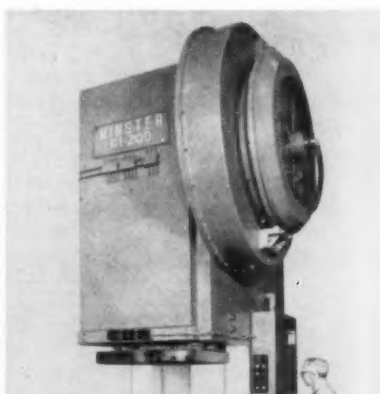
The tap extensions, available for tap sizes from #0 upward, are suitable for either production machine applications or hand-tapping work.

T-5-1762

Gap Press

The Minster Machine Co., Minster, Ohio, announces a G1 gap press with a fabricated steel frame. Standard specifications of these 200-ton capacity presses are: stroke of slide, 8 inches; speed of geared presses, 28 strokes per minute; bed area, 34 x 58 inches; slide area, 28 x 36 inches.

Prime feature of the press is the



frame which has been engineered and fabricated to achieve minimum deflection. Frame sections have been made massive to increase the compressive strength required in steel C frames and to build up the vibration dampening capacity of the frame. Rigidity and efficiency provided by the special construction, are among the main reasons for the performance of these G1-200 presses.

Minster G1-200 presses have barrel slide adjustment and unusually long slideways. Cross-bar type and cam knockouts are available as extra equipment. Pneumatic counterbalance cylinders are standard. These counterbalances float press slide and tooling, take up all bearing clearances, and reduce snap-through shock. Presses are fixed base as illustrated or power inclining.

T-5-1771

Metal Cleaner

Oakite Products, Inc., 158 Rector St., New York 6, N. Y., has developed an acid detergent, Compound No. 131, primarily for pickling and scale-removal operations in metalworking plants. The substance, which meets specification MIL-M-10578A, Type III, removes light to moderate rust, heat scale, tarnish, and other oxides, as well as normal shop dirt.

A nonviscous liquid, Compound No. 131 has a pH range of 1.5 to 1.0 at 70 F, and a bulk density of 11.0 lb per gallon. It is readily water or alcohol soluble in all proportions. It rinses easily in both hot and cold water. It may be used in a concentration range of 5 to 30 percent by volume. Recommended operating temperatures range from room temperature to 160 F.

T-5-1772

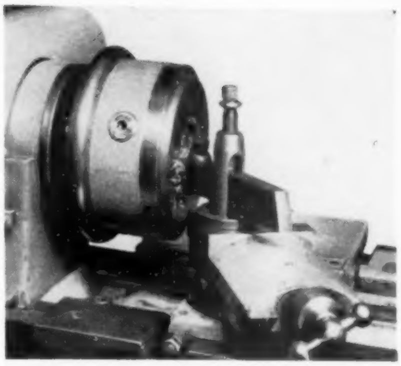
USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Magnetic Chuck Line

A complete line of permanent magnetic chucks has been added by The E. Horton & Son Co. to supplement their line of lathe chucks.

These additions, made in Holland to Horton specifications, are available in two types of rotary permanent magnetic chucks. The parallel type with parallel lines of force running the entire width of the chuck face is used for holding small components and thin plates; the circular type with circular lines of force holds rough surfaces and is useful for heavy-duty turning, milling and shaping.

The rectangular chucks feature a



lower over-all height which reduces the size limitation on pieces to be held.

Literature on these chucks is available from Horton, Windsor Locks, Conn.

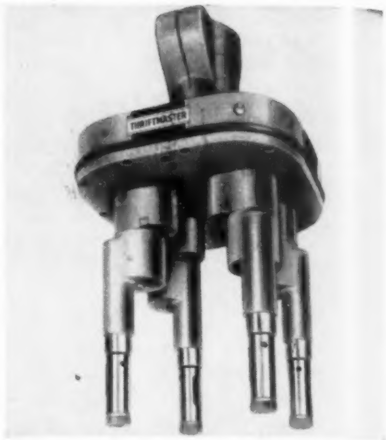
T-5-1773

Double Eccentric Drillhead

A new full ball bearing double eccentric adjustable drillhead is announced by Thriftmaster Products Corp., 1004B N. Plum St., Lancaster, Pa.

Spindles of this head have a very large range of adjustment and may be set to drill irregular hole patterns. All spindles are provided with vertical or depth adjustment. A special clamping device prevents damage to the head by excessive tightening and permits operation with or without spindle locating templates.

Head is completely sealed against oil leakage or dust penetration and may be operated vertically, horizontally, or inverted with accuracy and de-



pendability.

Twenty standard models are available with 3, 4, 6, or 8 spindles having drilling capacities up to $1\frac{1}{16}$-inch diameter holes in steel. They can be used for drilling, reaming, tapping or boring and arranged to fit any conventional drilling machine, and special models are available. **T-5-1781**

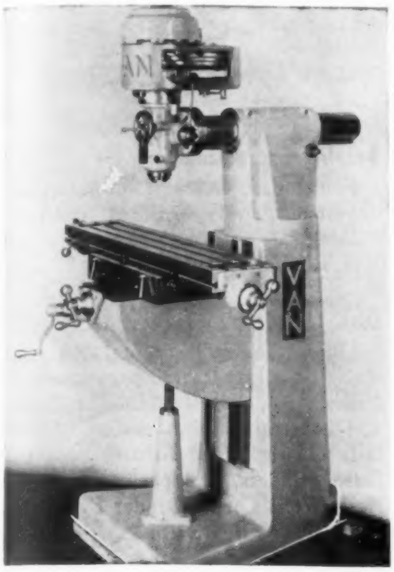
Overload Protection

A Dyna-Switch with 20,000-lb capacity has been developed by W. C. Dillon & Co., Inc., P.O. Box 3008, Van Nuys, Calif., which prevents overload damage to costly hoisting equipment by automatically cutting out lifting power whenever the safety maximum is exceeded.

Accuracy of the device is within $\frac{1}{2}$ of 1 percent, with a safety factor of $3\frac{1}{2}$ to 1, thus permitting accidental overloads up to 70,000 lb with complete safety and without damage to calibration. Dimensions of this compact instrument are $18\frac{1}{4}$ inches long by $6\frac{1}{4}$ inches wide by $2\frac{5}{8}$ inches deep and with a net weight of $20\frac{1}{2}$ pounds. It uses either 110 or 220/440-volt power supply. **T-5-1782**

V rtical Milling Machine

mmons Industries has introduced a p lar priced, variable speed vertical m called the Van vertical milling ma- ch e, which meets precision standards. mong its special features is a g ed overarm with handwheel con- tr for easy, positive and accurate in- an out movement of overarm for in-



creased cross milling capacity and ac- curate movement for change in setups.

The Van milling machine has eight spindle speeds: 90-2500 with ¾-hp motor, and 135-3750 with 1-hp motor. The spindle is driven by a timing belt designed to avoid belt slippage. The 3½ inch diameter hard chromed quill has 4-inch travel. Collet capacity is to ¾ inch, and individual toolholders are available up to 1 inch capacity.

Complete specifications with illustrations are available from Simmons Industries, 53 Shotwell St., Room #123, San Francisco 3, Calif. **T-5-1791**

USE READER SERVICE CARD ON PAGE 167 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Portable Wire Stitcher

An arm-type wire stitcher, made portable by the use of an aluminum frame which reduces the weight to 59 pounds, is available from Acme Steel Co., 2840 Archer Ave., Chicago 8, Ill.

The Acme-Champion Model K table-top stitcher draws round wire from a continuous-length five-pound reel, cuts it to proper length, forms stitches and clinches them at 200 per minute in material up to 1/8 in. thick. The machine, which has a 1/20 hp fan-cooled

motor, is actuated by an electric foot switch. A work-actuated trip can be supplied.

Driver, cutter blades, tension pawl and gripper have been made reversible, and the clincher may be reversed for inward or outward clinching of the stitch legs. The entire stitching head can be removed in one minute for maintenance.

The stitcher occupies bench space only 8 x 19 in., and is 21 in. high.

T-5-1792

Trade Literature

For Free Booklets and Catalogs — Convenient Request Card on Page 167

Gears

Illustrated brochure Engineering Manual DR No. 2 offered as a guide to selection, use and maintenance of complete line of Duti-Rated Lifetime gearing available as standard gear sets; also contains helpful data on efficient space-saving gear arrangements; includes design details, specification and dimension data. Foote Bros. Gear and Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill. **L-5-1**

Plastics

"Manual for Reinforced Plastics Tooling" offered as technical guide regarding fabrication, advantages, applications of such plastic tools; includes theoretical data as well as practical information based on actual operations in tool and die shops actively engaged in reinforced plastic tooling. Request only on company letterhead directly to Marblette Corp., 37-21 Thirtieth St., Long Island City 1, N. Y.

Jigs, Fixtures

Reissued catalog presents complete line of clamp assemblies and fixture details; illustrated by means of full size templates. West Point Mfg. Co., 26935 W. Seven Mile Rd., Detroit 19, Mich. L-5-2

Bearing Extractor

Folder describes and illustrates with drawings, new type of ball and roller bearing extractor. Engineering Imports, P.O. Box 557, Olean, N. Y. L-5-3

Disk Grinders

Line of double horizontal disk grinders is introduced in 16-page illustrated bulletin No. 200; contains application and construction information plus details of work feed fixtures used with these grinders, and performance data. Besly-Wells Corp., Grinder Div., Beloit, Wis. L-5-4

Welding

Performance and application information concerning consumable electrode inert gas welding process presented in 7-page booklet B-6525; discusses what the process is, what it will do, its cost, etc. Illustrated by photos, and graphs. Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa. **L-5-5**

Chucks

Folder W-200 provides combination catalog and price selector for line of lathe chucks; visual selection of particular chuck permits immediate location of specification details. Horton Chuck Div., of E. Horton & Son Co., Windsor Locks, Conn. **L-5-6**

Standards

Forty-eight page publication lists and indexes some 1500 American Standards with ordering and price information. American Standards Association, 70 E. 45 St., New York 17, N. Y. **L-5-7**

Cylinders

Two bruchures, A-104K and A-105K, contain up-to-date data on complete line of 200 psi and 2000 psi heavy duty air cylinders respectively; each covers design, engineering, construction, operational data of respective series. Miller Fluid Power Co., 2040 N. Hawthorne, Melrose Park, Ill. L-5-8

Alloy Steels

More than 60 factual case-histories document the economic advantages claimed for fabricating with alloy steels as they are highlighted in 200-page handbook, "Alloy Steels Pay Off," offered to technical, administrative and equipment maintenance personnel; stresses such points as long life, low maintenance, lower operating costs, plus advantages inherent in certain physical and chemical properties. Request only on company letterhead directly to Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y.

Honing

Detailed discussion of importance of microhoned surfaces of diesel components presented in Vol. 6 No. 5 of "Cross-Hatch"; illustrated. Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich. L-5-9

Plug, Ring Gages

Complete line of plug and ring gages, both thread and plain cylindrical, presented in catalog which includes description, illustration and specification and price list for each type gage covered. Winter Brothers Co., Rochester, Mich. L-5-10

Work Holders

Illustrated circular presents advantages and special features of company's multi-purpose work holders; included specifications and prices. Lassy Tool Co., Plainville, Conn. L-5-11

HSS Tool Bits

Folder lists company's molybdenum, tungsten and cobalt high-speed steel bits explaining advantages and particular uses for each; also gives information on proper grinding and mounting of bits. The DoAll Co., Des Plaines, Ill. L-5-12

Casting Sealer

Illustrated circular presents three methods for sealing of pressure castings by means of company's plastic and metallic seals; outlines characteristics of substances and explains advantages of use. Seal Cast Co., Inc., 2113-15 E. York St., Philadelphia 25, Pa. L-5-13

Holders for Inserts

Special features and advantages of its Multicut series of holders discussed in illustrated bulletin No. 552-M; sketches and photos show holders, principal components and typical operations of each of six basic styles; lists sizes, shank and insert dimensions and prices. Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20, Mich.
L-5-14

Double Pumps

Four-page folder DP-308 describes company's PF100 series of 2,000 psi variable delivery hydraulic power units outlining efficiency, economy and other advantages of these double pumps equipped with integral valve panels; illustrations show construction details, dimensions; includes performance data and installation information. Dudco Div., New York Air Brake Co., 1700 E. Nine Mile Rd., Hazel Park, Mich.
L-5-15

Precision Switches

Ten classifications of standard line of precision snap action basic switches presented in well illustrated 28-page catalog No. 62 which includes photos, dimensional drawings, terminal variations, electrical ratings and technical information; offers help to design engineer concerned with proper selection of switch for particular requirement. Micro Switch Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.
L-5-16

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-182

Dust Collector

Illustrated leaflet, Bulletin 810, presents details of Cyclone Duskollector Model CYO-8 which, though compact, offers capacity great enough to collect dust from both sides of two average polishing and buffing lathes; includes dimensions and specifications. Hammond Machinery Builders Inc., 1600 Douglas Ave., Kalamazoo, Mich.
L-5-17

Coolant

Informative booklet "How to Stop Foul Coolant Odors" describes in detail procedure for eliminating odors caused by rancid water soluble coolants; also tells how to keep equipment free of offensive coolant odors. S. C. Johnson & Son, Inc., Racine, Wis.
L-5-18

Fastening

Twenty-four page Engineering Data Section covers 14 topics concerning techniques in manufacture and proper installation of company's special and standard hexagon nuts; includes such items as a guide chart for calculating wrench torques, thread tolerances and gaging. National Machine Products Co., 44225 Utica Rd., Utica, Mich.
L-5-19

Conveying Equipment

Indexed 340-page guide contains information useful to engineer or layout man concerned with selecting standard power transmission and conveying equipment for new installations or for replacements; covers data on complete line of chains for conveying and power transmission, ball and roller bearings, gear drives, clutches, gears, couplings etc.; includes tables of pre-selected assemblies, capacity charts and dimension tables for standard products. Request catalog No. 950 direct from Link-Belt Co., Dept. PR, 307 N. Michigan Ave., Chicago 1, Ill.

Collets

Simplified guide for ordering collets, Bulletin 54, lists specifications, dimensions, conversion and interchangeability features and prices in tabular form designed for easy reference; illustrates various styles. Hardinge Brothers, Inc., Elmira, N. Y. L-5-20

O-Rings

Catalog No. AD-148 gives design information, recommended pressures and available materials for both dynamic and static applications of company's line of O-rings; contains complete list of standard sizes regularly stocked by company's sales offices. The Garlock Packing Co., Palmyra, N. Y. L-5-21

Plating

Thirty-two page picture-and-text booklet, "Precision Plating, a Product and a Service," describes plating facilities of its new million-dollar plant which has been opened to precision job plating from outside firms; discusses technical aspects of plating and stresses importance of precision work. Standard Pressed Steel Co., 786, Jenkintown, Pa. **L-5-22**

Heavy Duty Lathes

Descriptive bulletin No. 1601 presents details on company's Series 90 Dyna-Shift heavy duty lathes designed specifically to utilize carbide tooling to best advantage on large work; covers simplicity of operation, design details, advantages, specifications; extensively illustrated. Request only on business letterhead directly from The Monarch Machine Tool Co., Sidney, Ohio.

Carbides

Carbide catalog shows complete line of blanks, tools and inserts together with technical information on proper grade selection; covers various new items such as standard blank sizes and rectangular, strip sizes, as well as triangular, square and round Throw-Away, Half-Length and standard inserts. Vascoloy-Ramet Corp., Waukegan, Ill. **L-5-23**

Steel

Folder offers details of forged high speed steel tools, stressing wearing and performance advantages and comparing them to conventional high speed steel tools. Modern Tools Div., Nelco Tool Co., Inc., Berlin, Conn. **L-5-24**

Angle Plates, Chucks

Four-page illustrated catalog No. 812 deals with construction and applications of the company's new sine angle plates and sine angle magnetic chucks, explaining their uses and applications. The Taft-Peirce Mfg. Co., Woonsocket, R. I. **L-5-25**

Motors

Twenty principal types from company's line of improved motors presented in extensively illustrated brochure 1878. U. S. Electrical Motors Inc., Box 2058, Los Angeles 54, Calif. **L-5-26**

Blast Cleaning

Four-page folder discusses physical and chemical characteristics and performance of nonmetallic, dustless Mono-Kleen mineral shot for blast cleaning; illustrated to show various points. Baldwin-Hill Co., 500 Breunig Ave., Trenton 2, N. J. **L-5-27**

Men at Work . . .

Two new vice-presidents have been added to the management of Lunkenheimer Co. **Eibe W. Deck**, formerly vice-president and works manager of The Wico Electric Co., was elected vice-president in charge of production; and **Earl F. Riopelle**, who previously was vice-president in charge of engineering of Houdaille-Hershey Corp. was elected vice-president in charge of engineering and research.

Anderson Corp., has revealed three executive changes: **S. Malcolm Blanch,** former clerk-treasurer of the company, was elected chairman of the board in addition to his other positions; **Brent R. Anderson,** former vice-president, was elected president; and **William C. Arthur**, who has been assistant to the treasurer at Norton Co., was elected vice-president and assistant works manager for Anderson.

During the recent convention of the Society of Plastic Engineers, **Frank W. Reinhart,** chief of the Organic Plastics Section of the National Bureau of Standards, was elected president for the coming year.

Gordon A. Sommer has been named to head the new development and research department set up by Clearing Machine Corp., division of U. S. Industries, Inc. Mr. Sommer's former position as chief engineer of Clearing's Hamilton, Ohio, plant, is now filled by **Joseph A. Geuss.** Mr. Geuss, who has been with Clearing for the past 17 years, was engineering supervisor at the Chicago plant.

Appointment of **William A. Damerel** as a vice-president and **Fred Schulman** as assistant director of research has been announced by Mercast Corp. Mr. Damerel was formerly works manager of the American Bosch Co., while Dr. Schulman previously served as technical director for Herrick L. Johnston Inc. He is still a director of that company.

At the same time, **A. F. Anzlovar** was named vice-president of Mercast Mfg. Corp., a California plant which is expected to be in operation by July.

Election at the stockholders meeting added three new men to the board of directors of American Wheelabrator & Equipment Corp. They include **Leslie L. Andrus,** vice-president of the corporation and executive head of its Dust & Fume Control Div.; **Harold M. Miller,** vice-president of the corporation since 1944; and **Ray P. Whitman,** first vice-president of Bell-Aircraft Corp.

Election of **Gordon Kiddoo** to the office of vice-president of development has been announced by National Research Corp. He has been director of the company's development department for the past three years.

Joseph I. Bosi has been appointed chief engineer for the Hydro-Line Mfg. Co. He has been associated with that company since 1950.

Robert B. Murray, Jr., who recently resigned as one of the chief aides to U. S. Secretary of Commerce, has joined The Baldwin-Lima-Hamilton Corp. as special assistant to the president.

William L. Shank was named works manager of Kearney & Trecker Corp.'s special machinery division. For the past five years he has been vice-president in charge of manufacturing at Ingersoll Milling Machine Co.

L. D. Huffman is new director of engineering of The Colson Corp. He formerly was chief engineer for the Service Caster & Truck Corp., and earlier had been in charge of that firm's experimental department.

Edward C. Conner is now works manager of the Greensburg (Pa.) Works of the Walworth Co., succeeding Carl Lundbom who retired. Mr. Conner was previously production control manager for the company.

Ben H. Ward has been appointed manager of the factory division of The Lees-Bradner Co. He assumes responsibilities of his new position while he continues in his capacity as assistant treasurer of the company.

George B. Beitzel, president of Pennsylvania Salt Mfg. Co., has indicated his desire to retire when he completes 25 years' service with the company, and recommended **William P. Drake** be appointed executive vice-president and elected to board membership. The company's board approved both recommendations. Mr. Drake, who has been associated with Pensalt for 21 years, was most recently president of its Industrial Chemicals Div.

Three executive personnel changes have been announced by Shakeproof Div., Illinois Tool Works. **A. L. Pontius,** who has served in various executive capacities with the company since joining it in 1952, was made general manager of the Stamped Products Div. **William E. Bruse,** formerly plant superintendent, was named general manager of the Threaded Products Div. **Kenneth C. Mackay,** formerly administrative assistant to the vice-president, is now assistant general manager of the Threaded Products Div.

Three promotions at the switchgear department of Allis-Chalmers Boston Works involved **H. L. Peek,** who was made engineer-in-charge of the development group; **W. L. Vance,** who became engineer-in-charge of circuit breaker design; and **J. F. Claffie,** who was named to section engineer for high voltage outdoor breakers.

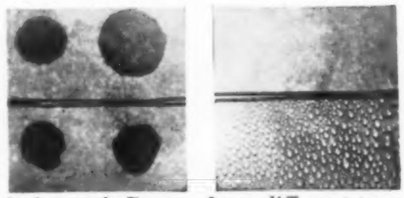
C. Thorpe Thompson has been named executive vice-president and general sales manager of Cleveland Instrument Co. He will head the company's expanding activities in the field of automatic gaging, sorting and control units.

Announcemnt of appointment of **Louis Srybnik** as director of a special projects division has been made by the S & S Machinery Co.

Technical Shorts...

Metal Finishers Benefit from Oil Test Data

ADVANCE KNOWLEDGE about how difficult it will be to remove a given oil from a metal surface can be gained by simply timing the speed with which a drop of oil spreads over a clean sample of the metal involved. The more rapidly the oil spreads, the easier it will be to clean off later. The correlation was discovered by researchers at Columbia University working on a program of metal-cleaning problems



Left panel: Drops of two different type oils (one above, one below) show difference in spreading rates. Right panel: metal strip, cleaned of oil samples, is water sprayed. Droplets on panel that held slow-spreading sample reveals some oil still adheres to it.

sponsored by American Electroplaters' Society. Generally speaking, metal fabricators and finishers and electroplaters use oils of unknown chemistry for corrosion prevention. Such oils must then be removed before subsequent paint or electroplating.

Investigation established definitely that oils that spread quickly are more readily removed—and conversely that oils which spread slowly adhered more tenaciously. Certainty of this data now may help in development of better rust preventatives, more durable wax finishes or stronger filmed motor lubricants.

Study particularly of the more rapidly spreading oils is expected to speed development of cutting tool coolants and lubricants that are easily removed which will speed production without loss of tool life.

* * *

Film on Machining by Electrical Discharge

SPECIAL TECHNIQUES involved in electrical discharge machining of metals are presented in a color motion picture recently released by the Elox Corp. The film explains the theory, application and benefits of this method of cutting shapes into even hardest metals, including tungsten carbide, without heating either the work or the tool. Various scenes show the pertinent factors of the operations. An underwater sequence filmed through a glass tank filled with liquid coolant, explains what factors must be controlled to make the process work. Special setups that could be dis-assembled to give the camera a cross sectional view, permit the audience to see actual cuts in progress.

Arrangements for film showings may be made through Elox, 740 N. Rochester Rd., Clawson, Mich.

* * *

Casting Process for Fine-Finish Work

MICROWAVE PLUMBING for radar and sonar is being cast at the Howard Foundry Co. by a method which combines the techniques of both the plaster and investment processes. The new method, called the Ellis process, produces dense castings that will pass 100 percent x-ray and Zyglo inspection. Castings have been obtained with the Ellis method that have an as-cast finish ranging from 10 to 20 microinches, while a maximum of 30 microinches is obtained consistently in production.

To date, the company has cast beryllium copper and aluminum alloys by the new method.

Vho's Meeting - and Where

May 4-7. National Screw Machine Products Association. Annual meeting, Statler Hotel, Buffalo, N. Y. Pertinent details are available from association headquarters, 2860 E. 130th St., Cleveland 20, Ohio.

May 6. Annual Conference for Engineers, sponsored by Ohio State University, College of Engineering. Secure more information from Assoc. Dean Harold A. Bolz, ACE General Chairman, College of Engineering, Ohio State University, Columbus, Ohio.

May 7-15. The Society of the Plastics Industry, Inc. Annual meeting and conference to be held during cruise on Queen of Bermuda. More information may be obtained from society office, 67 W. 44th St., New York 36, N. Y.

May 9-11. Metal Treating Institute. Annual spring meeting, Ambassador Hotel, Los Angeles, Calif. For details contact institute office, 271 North Ave., New Rochelle, N. Y.

May 10-12. Metal Powder Association. Metal Powder Show and annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa. Write for more details to society headquarters, 420 Lexington Ave., New York 17, N. Y.

May 12-14. American Institute of Industrial Engineers, Inc. Sixth annual conference and convention, Kingsway Hotel, St. Louis, Mo. Obtain details from Mr. Andrew Zunzer, convention publicity chairman, 8100 Rockwood, St. Louis 23, Mo.

May 16-20. American Materials Handling Society. National Materials Handling Exposition, International Amphitheatre, Chicago, Ill. Complete information is available from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

May 18-20. Porcelain Enamel Institute. Mid-year division conference, Edgewater Beach Hotel, Chicago, Ill. Contact institute headquarters, Dupont Circle Bldg., 1346 Connecticut Ave., N. W., Washington, D. C. for details.

June 2-4. National Society of Professional Engineers. Annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa. Write to society headquarters, 1121 Fifteenth St., N. W., Washington 5, D. C. for more information.

June 8-10. American Welding Society. Annual welding show, Municipal Auditorium, Kansas City, Mo. Spring technical meeting of the society to run concurrently June 7-10. For details contact society's management office, Suite 1006, 12 E. 41st St., New York, N. Y.

June 19-23. American Society of Mechanical Engineers. Semi-annual meeting, Boston, Massachusetts. For more data write society office, Engineering Societies Bldg., 29 W. 39th St., New York, N. Y.

June 20-23. American Society of Mechanical Engineers. Semiannual meeting, Statler Hotel, Boston, Mass. For particulars contact society headquarters, 29 W. 39th St., New York, N. Y.

June 20-24. American Society for Engineering Education. 63rd annual meeting, Hetzel Union Bldg., Pennsylvania State University, State College, Pa. Direct inquiries to Prof. K. L. Holderman, General Chairman, 103 Mechanical Engineering Bldg., Pennsylvania State University.

June 24-26. Society of Women Engineers. Annual meeting, Hollywood Knickerbocker Hotel, Los Angeles, Calif. Complete information available from convention chairman, Mrs. Frances Rittamel, 3305-C West 83rd St., Ingelwood, Calif.

June 26-July 1. American Society for Testing Materials. Annual meeting, Chalfonte—Haddon Hall, Atlantic City, N. J. For more information, write society office, 1916 Race St., Philadelphia 3, Pa.

June 27-29. American Nuclear Society. First annual meeting, Pennsylvania State University, State College, Pa. Details may be obtained from society headquarters, Room 3000, 329 W. 41st St., New York 36, N. Y.

July 12-14. Western Plant Maintenance Show, to run concurrently with Western Plant Maintenance and Engineering Conference, Pan Pacific Auditorium, Los Angeles, Calif. For full particulars, write show producers, Clapp & Poliak, Inc., 759 Monadnock Bldg., San Francisco 5, Calif.

Field Notes...

A technical society, the Society of Die Casting Engineers, has been formed to foster and further technological advances in the field of die casting and finishing of metals and die molding of plastics and of powder metals. First chapter to be formed with the organization is the Detroit No. 1 chapter.

Officers of the groups are Harris Shimel, of Chevrolet-Bay City, president; Marshall Aberle of H & M Industries, vice-president; George Griffenham of Mergraf Oil Co., secretary; John Lapin, Saginaw Bay Industries, recording secretary; Arthur Tinetti, A.C. Spark Plug, treasurer; and Mike Tenenbaur, Lester Phoenix Machine Co., librarian and historian. Address of the society is 175 Railroad St., Northville, Mich.

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Announcement has been made of the formation of National Diamond Laboratory of California to manufacture a line of diamond tools, wheels, hones and diamond powder for West Coast industry's needs. Location of the new plant and its offices is 1605 E. Colorado St., Glendale, Calif.

purchases

Sale of its wholly owned subsidiary, The Cleveland Tapping Machine Co. has been announced by Automatic Steel Products, Inc. Purchaser was the H. P. Townsend Mfg. Co. No change in name is expected, and the business of Cleveland Tapping will remain at its present location with the same personnel.

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Complete ownership of Ruge-de Forest, Inc., an industrial testing-equipment and electronic manufacturer, has been acquired by Baldwin-Lima-Hamilton Corp. as part of that company's diversification and expansion program.

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Transfer of assets of the Houston Carbide Corp. has been made to Firth Sterling, Inc. The acquisition was made, according to Kenneth D. Mann, president of Firth Sterling, to provide greater service in the state of Texas and the South as a whole. The Houston plant will be operated as a division of Firth Sterling, with its existing organization remaining unchanged.

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Announcement of the purchase of the plant and stocks of Arthur C. Harvey Co., Boston steel and aluminum distributor, has been made by Joseph T. Ryerson & Son, Inc., who plans to consolidate its Greater Boston operations at the Harvey plant. According to Carroll S. Harvey, president of the acquired company, personal and health reasons brought about the decision to dispose of the business.

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Fulton Iron Works Co. has purchased the Lehmann Boring Tool Div. of Novo Engine Co. The exchange included all facilities of the division including plant and production equipment. Key management personnel as well as production supervisors and employees were retained.

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Complete line of Rockwell (Delta-Milwaukee) hydraulic drill units has been purchased from Rockwell Mfg. Co.

by The Hartford Special Machinery Co. Hartford Special assumed manufacture, sales and servicing of the units which will be produced by that company's new Simsbury (Conn.) plant. All special equipment, tools and inventory were transferred from Pittsburgh to Simsbury. In addition, key sales, engineering and production personnel were retained and relocated in the Hartford area.

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Entire machinery and special equipment inventory of Amco Gage Co. has been purchased by Master Spline Co., which then moved its operations into Amco Gage's building at 19760 W. Eight Mile Rd., Detroit. In addition, to better identify the wide coverage of the company's manufacturing and designing facilities, name of the company has been changed to Master Spline Tool & Gage Co.

expansions

A new factory building in Chicago for the Morton Grove section of Minneapolis-Honeywell Regulator Co. is now under construction with completion data set for November. Estimated cost of the facility is $1,750,000. The venture was started to consolidate manufacturing operations now carried on at various locations in the city.

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Manufacturing facilities of the Square D Co. will be considerably expanded by mid-1955 with completion of new plants in Secaucus, N. J. and Cedar Rapids, Ia. This is a continuation of the expansion program which has doubled Square D facilities in less than 10 years.

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The Christopher plant of Gear Grinding Machine Co.'s machine tool division has been increased to provide a 33 percent larger plant area, to permit expansion of production of its single spindle screw machine, as well as the gear grinding machines. The half-million dollar program will include, in addition, revamping present production facilities.

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Production is under way at two new aluminum welded tube mills at Aluminum Co. of America works in Alcoa, Tenn. These mills will provide the company with the capacity to produce aluminum tube and pipe from ½ to 8 in.

in diameter. With these two new additions, Alcoa is able to produce extruded, welded or drawn tube and pipe.

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The $2-million plant for Bridgeport Thermostat Div. of Robertshaw-Fulton Controls Co. is nearing completion and will be ready for occupancy in July. The entire staff of the existing plant in Bridgeport, Conn., is expected to move to the new quarters in Milford, about six miles from downtown Bridgeport.

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Work is under way on a $300,000 engineering building for The Cleveland Crane & Engineering Co. in Wickliffe, Ohio. This will be the third building in an expansion program started in January of this year.

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New $5-million plant for General Metals Corp., subsidiary of Transamerica Corp. has been completed and is now in operation. It is the largest heavy industry foundry in the West. Important aspect of the facility is its utilization of automation in its manufacturing processes, including fully automatic molding machines.

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Sandvik Steel, Inc., is building a new 85,000 sq-ft plant in Fair Lawn, N.J., which will consolidate the company and its four divisions in one central location. When completed, the facility will provide for rolling and slitting strip steel, manufacturing springs, fabricating steel belt conveyors and warehousing all Sandvik products.

license agreements

Lead-treated steels are now being produced under license at Jones & Laughlin Steel Corp.'s Aliquippa, Pa., Works, for the making of cold finished bars in the J&L 1213 and Type A analysis of leaded open hearth steel, and the J&L 1113 Bessemer analysis. Other grades of lead-treated open hearth steel also are to be produced, while hot rolled bars and wire will be available for special applications.

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Cross-licensing agreement has been made between Baldwin-Lima-Hamilton Corp. and Carl Schenk, Darmstadt, Germany, involving testing equipment. Baldwin will now manufacture and sell

the Schenk line of fatigue testing equipment; and the right to manufacture and sell Baldwin SR-4 bonded resistance wire strain gages, devices, testing machines and associated instrumentation in Europe was given in return to the German firm.

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Contract to manufacture Meehanite castings has been made by the Nordberg Mfg. Co. with The Meehanite Corp. Under its terms, Nordberg will produce Meehanite castings in both its Milwaukee and St. Louis foundries.

new offices

Midwest regional branch office for Denison Engineering Co. has been opened at 7000 W. 63rd St., Chicago. According to the company, opening of this branch and subsequent branches in the near future is part of a program to completely decentralize sales. The branches will carry a wide inventory of all Denison products, so that over-the-counter sales will be an actuality.

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A branch of Wall Colmonoy Corp.'s Stainless Processing Div. has been opened on the West Coast to provide manufacturers there with contract brazing and heat treating facilities for stainless steel alloys and aircraft components. Murray J. Granger, formerly with Aerojet-General, is plant manager of the new facility.

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New office for the Ohio Knife Co. has been opened at 140 Penn Ave., Salem, Ohio, with W. Wentz Alspaugh in charge.

moves

Facilities of Midwest Precision Castings Co. have been moved to 10703-09 Quincy Ave., Cleveland. The new quarters consist of an office, engineering and foundry building, while new equipment and methods which have been added are aimed at increasing production and lowering costs.

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Firth Sterling Inc. has moved its Southwest district office to 831 S. 75th St., Houston 23, Texas following acquisition of the Houston Carbide Corp. located at that address. Consolidation

of sales and production personnel at the plant facilities is expected to provide a coordinated service for customers in that area.

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Los Angeles district office of the Norton Co. has been moved to 5905 Pacific Blvd., Huntington Park, Calif. Robert W. Cushman is the West Coast district manager.

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Milwaukee offices and warehouse for Ziv Steel & Wire Co. have been moved to 2225 S. 38th St., a change aimed at expediting deliveries to customers in the Milwaukee area.

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Offices and assembly area of Hypro Engineering Inc. have been moved to new quarters at 700 39th Ave., N.E., Minneapolis.

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Eastern district office of The Yoder Co. has been moved from New York City to the Ridgeway Professional Bldg., Stamford, Conn.

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Eastern regional sales office of Alloy Tube Div. of The Carpenter Steel Co. has been moved to the division's home office and mill in Union, N.J. Paul E. Kelly will continue in his capacity as eastern regional sales manager.

metal news

Titanium melting capacity has been tripled at Mallory-Sharon Titanium Corp. with the completion of a new melting plant. The new facility houses four double-melting furnaces, used for both first and second stage melting of the metal from sponge to ingot form. The increase brings the company's capacity to 3,000,000 pounds a year.

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Capacity of the big aluminum smelter at Kitimat, British Columbia, will be more than doubled to meet increasing demands of the production world, according to announcement by Aluminium Ltd. Presently installed capacity of the facility is 91,500 tons; under construction is facility for 60,000 tons authorized last October, and the new plan will add another 180,000 tons, bringing total productive capacity for the plant to more than 330,000 tons annually. The completed program is expected to come into operation in 1959.

abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Gear Train Analysis

Gear trains for spindle drives in machine tools have been standardized for many years in Germany. There, geometric progression of the spindle speeds is based on the fortieth root of ten and its multiples, making possible simplified design and standardization. Gears can thus be produced in greater quantities at reduced cost and with better accuracy.

An analysis of gear trains has been made by E. Stephan and published in number 1 issue, 1955 of *Werkstattstechnik und Maschinenbau* on the conditions for obtaining the least number of teeth in gear trains in headstocks of lathes, drilling machines and other machine tools. He has developed a graphical-analytical method for obtaining optimum conditions for distribution of the speeds, progression, number of teeth, shaft velocities, loads, utilization of available space and similar considerations. The investigation takes advantage of standized transmission ratios (German Standard DIN 804). It demonstrates that by combining them in various ways other standardized ratios are easily obtained. The author first considers the effect of the smallest gear in the largest transmission ratio in a drive. He shows that the total sum of the gear teeth varies proportionally to the chosen number of teeth of the smallest gear, increasing by as much as 33 1/3 percent if the number of teeth of the smallest gear is made 24 instead of 18.

The author continues with a discussion of the four possibilities for the design of a gear train consisting of three shafts, which gives six spindle speeds in geometric progression. He also considers the desirable minimum center distance of the shafts. The article contains a complete computation of two gear trains each with 18 spindle rpm and five shafts. The lowest spindle speed is 35.5, the highest 1800 rpm at a geometrical progression of 1.25. In one case the number of gears is 18 and the

total number of teeth 554, while in the other case only 17 gears with a total of [illegible]23 teeth are required. The sum of the center distances in the first example is [illegible]60 mm (14.2 inches) and 379.5 mm (1[illegible]4 inches) in the second example. The conclusions contain recommendations for optimum design.

Machine Tool Development in USSR

Almost all types of machine tools are now made in the Soviet Union, including the heaviest, which are manufactured in the satellite countries according to E. Broedner in Number 74, 1954 of German *Industrie Anzeiger*. The author visited Russia in 1932 and again in 1951. He reports on the distribution of the Russian machine tool industry, which is being shifted towards Manchuria and China. The northwestern provinces of China are rich in oil and coal and are therefore a significant basis for future industrial development, particularly for machine tools.

In 1932 there were only 180,000 machine tools in operation in the USSR, while their number has increased to 1,320,000 machines in 1950 as against 7,750,000 machine tools in USA. Lack of skilled machine tool operators is the greatest drawback. For this reason the Russian machine tool industry is instructed to design according to detailed standards permitting use of built-up units at as many places as feasible. Such standards include size and type of beds, columns, hydraulic units, chucks and gears, and are used even on transfer machines. One such machine is composed of 14 stations for the machining of cylinder heads with 134 tools, 20 motors and has a length of about 50 feet. It is in operation in an East-German factory. Another mass production machine for automation of piston production requires only four operators including inspectors and shipping personnel.

Metal-cutting research in Russia is concerned with super high-speed cutting, vibration, deep-freeze cooling, etc. The article also shows machine tools made in China, among them a twist drill grinder and a grinding machine with Filmatic bearings.

Bevel Gear Design and Standards

In the January 1955 issue of *Werkstattstechnik und Maschinenbau* E. H. Richter reports on the recently published German Standard 3971, dealing with basic concepts involved in the design of bevel gears and the determination of errors. The article discusses in detail mathematical correlations of the flanks, profile, pressure angle, angle

of inclination, pitch, errors in pitch, errors of engagement, octoid, spherical involute, reference system for measurements, individual errors and cumulative error.

Statistical Inspection

Sampling as a method of inspection is the topic of an article by Ulrich Graf and Rolf Wartmann, published in the same issue of *Werkstattstechnik und Maschinenbau*. They have investigated the problem of the required frequency of taking production samples for inspection to obtain optimal conditions. The mathematical analysis takes into consideration the number of pieces that may be produced before a change in a setup is required in order to duplicate the desired accuracy. Also it includes the size of the lot to be tested, and the tolerance. A simple formula is given for the time intervals at which the samples should be inspected. In the same issue the authors cite another example for statistical inspection, indicating that under certain conditions it is possible to replace the decimal system for sampling by a system based on the numeral six as is the case with the dots on the six faces of dice. They have used dice in conjunction with their formula for such inspection sampling.

Drilling of Rectangular Holes

An accurate method for drilling of rectangular holes or multisided holes developed by application of tracer control methods copying from a master is described by B. Bonz in issue number 2, 1955 of *Werkstatt und Betrieb*. The author describes the design of the tool, and the tracer device. Several illustrations and diagrams supplementing the article show how the true rake angle, the clearance angle and other significant data of the tool geometry vary as the tool rotates. Cutting speed varies between about 35 fpm at zero position of the tool and 15 fpm at 45 deg and increases again to 35 fpm at the 90 deg position of the tool. This cycle repeats but must be so arranged that the tool has a prescribed position at a sharp corner. It must have a helical clearance face.

Elliptical holes can likewise be cut in this way. It is claimed that the profile of the hole, either elliptical or with sharp corners, can be reproduced to an accuracy of 0.0004 inch and that sharp corners with radii of less than 0.020 inch can be machined.

Forty U.S. manufacturers exhibited equipment at the German Industries Fair in Hanover. Due to the number of Americans visiting and exhibiting, April 29 was designated U.S. Day.

Readers' Viewpoints

. . . die clearance

To the Editor:

I have just read "Interchangeability of Stock in Die Sets," March, p. 109, abstracted from the new handbook. I was rather surprised to find usage of the term "total clearance." It is my opinion that this term has contributed more to the confusion of die clearances than any other factor, and it would certainly be unwise to perpetuate this. The alternate term, "clearance per side," is more widely accepted and much preferred since it is logical and impossible to misinterpret, and applies to any contour.

Assuming that the term used in the reference sheet means what it says, i.e., 2 times the actual clearance per side, may I also point out that the values given are quite probably in error, and would correspond roughly to older, disproved data on this subject.

As an example, for cold rolled steel, a value of 6 percent total, or 3 percent per side is suggested. Compare this with the data on page 1499 of the *Tool Engineers Handbook*, lines 19 and 20, and table 97-2, giving a value of 6 percent per side. Even this higher value is now generally considered too low.

In *Plastic Working of Metals*, E. V. Crane, a value of 10 percent per side is listed as optimum for cold-rolled steel. I have suggested, *American Machinist*, April 12, 1954, pp. 245-246, a value of 9 percent per side. Comparisons with other materials will show similar disagreement.

Don R. King
Senior member ASTE
Milwaukee, Wis.

We believe Mr. King to be essentially correct in his appraisal of the "total" clearances referred to in the reference sheet on "Interchangeability of Stock in Die Sets," pp. 109-110, March issue of The Tool Engineer.

A final review of the original material, made after the type was set and printing started, determined that for best average practice the word "total" should be deleted throughout the text and from the chart. That is to the way it will appear in the forthcoming ASTE *Die Design Handbook*, and tabulations throughout the handbook will be based on *clearance per side*.

The original data were taken from the operations manual of a most responsible company, but may well have reflected that company's moderate production with less critical regard to long tool life, and possibly their need to keep burr down to a very low figure.

We trust that readers of the handbook will benefit from the prime purpose of the reference sheet data, which is to provide a method for calculating use of the same die on materials of different composition, condition, and thickness.

Frank W. Wilson
Chief Books Editor
American Society of Tool Engineers

good reading

SONICS *by Theodor F. Hueter and Richard H. Bolt. Published by John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $10. 456 pp.*

An exposition of analysis, testing and processing of materials and products by the use of mechanical vibratory energy is discussed in this book. Industrial application, technique and application are stressed.

Applications are divided into sonic processing and analysis, with typical examples to illustrate operating principles. Wherever possible, a discussion concludes with simplified engineering formulas and practical instructions for their use. The results of equations are frequently condensed into tables and design curves for immediate engineering use.

THERMODYNAMICS *by Franklin P. Durham. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. Price $7.35. 312 pp.*

Theory of thermodynamics is developed in this book in terms of a minimum number of simple equations to eliminate memorizing many specialized equations and to focus the reader's attention on important relations. Fundamental relations are divided into two groups: those that apply to any thermodynamic medium and those applying to the ideal gas.

The requirements for and necessity of reversible processes in the analysis of ideal thermodynamic processes are presented as simply as possible. The concept of entropy is introduced early in the text and integrated throughout, along with the treatment of irreversible processes.

WETTABILITY OF NYLON, POLYETHYLENE BY HYDROGEN BONDING AND HALOGENATED LIQUIDS, PB111448. *Office of Technical Services, U. S. Department of Commerce, Room 6227, Commerce Bldg., Washington 25, D. C. Price $0.50. 7 pp.*

This interim report is based on observations of the equilibrium contact angle formed by a liquid drop resting on solid surfaces of cleaned and polished disks or films. The report indi-

cate that these results showed wettability by polar hydrogen bonding liquids is increased by the presence of both the amide group and the ester group in the solid surface, but to a greater extent by the amide group.

THE MEASUREMENT OF PARTICLE SIZE IN VERY FINE POWDERS *by H. E. Rose. Published by The Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Price $2.75. 127 pp.*

This book consists of four illustrated lectures and discusses the most efficient methods for determining particle shape and size important in the control of production and processes.

Among the subjects discussed are: particle size measurement, size frequency, specific surface and shape, sedimentation apparatus, theory of the photo-extinction method of size frequency determination, and suspension fluids and dispersing media.

RESEARCH AND DEVELOPMENT OF METALS AND ALLOYS FOR LOW-TEMPERATURE APPLICATIONS, PB111453. *Office of Technical Services, U. S. Department of Commerce, Room 6227, Commerce Bldg., Washington 25, D. C. Price $2.00. 40 pp.*

This report of the panel on metals for use at low temperatures gives conclusions and recommendations for improving the efficiency of military equipment operating at temperatures down to -80 deg.

The basic problems of low temperature operation are discussed, including the brittle fracture of ferritic steels and the mechanism of deformation and fracture. Also discussed is the development of improved welding techniques and nondestructive test methods, varying service-stress conditions, the economy and availability of raw materials, and the establishment of performance criteria. An appendix presents topical reports reviewing low-temperature problems and properties of the principal metals and alloys.

THE CUPOLA AND ITS OPERATION. *Hans J. Heine, Technical Director, American Foundrymen's Society, 616 S. Michigan Ave., Chicago, Ill. Price $9.50. $6.00 to AFS members. 332 pp.*

This illustrated book discusses the historical development of the cupola and traces its progress to the present. Among the subjects discussed are: refractory lining and daily maintenance, tapping and slagging, alkali desulfurizers and desulfurizing, operating problems and techniques, equipment, and materials and principles related to operations.

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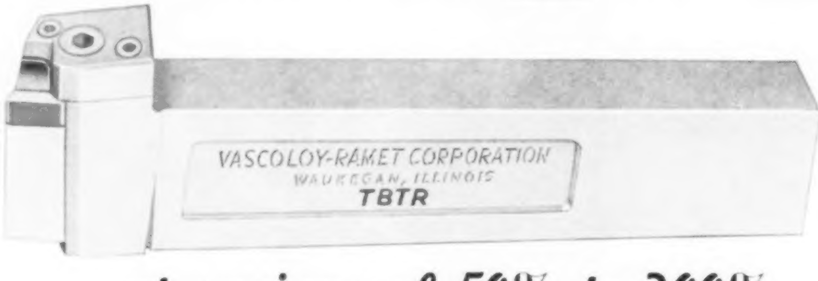

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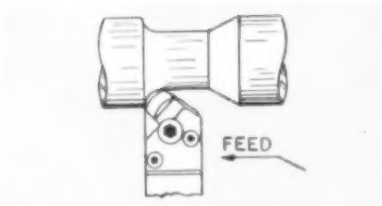

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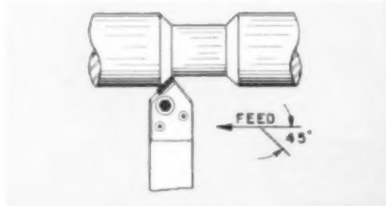

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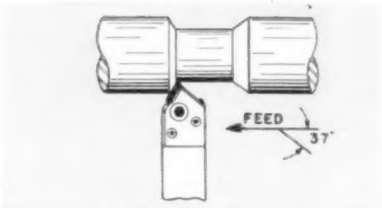

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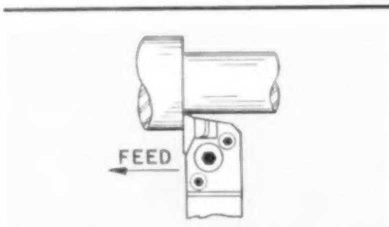

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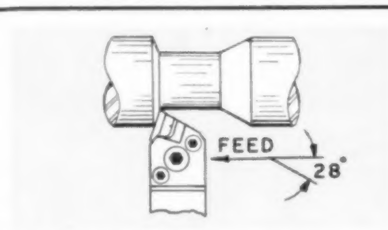
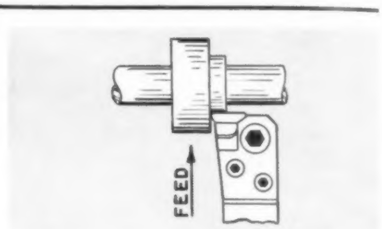
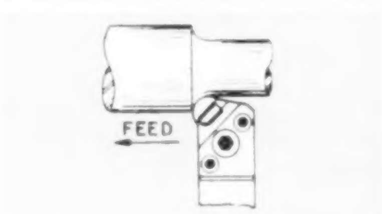


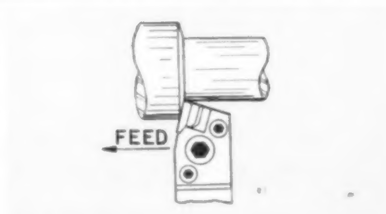
TBR For plunge turning with triangular inserts.



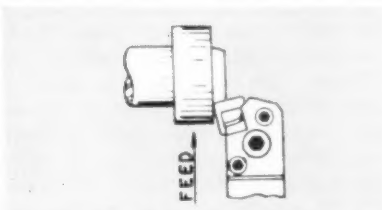
TFR For straight facing with triangular insert.



RAR For straight turning, facing and chamfering with a round insert.



SBR For straight turning, plunge feed turning, vertical turning, facing and chamfering.



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Cost Savings by Materials Management

By Joseph Gurski
Supervisor, Materials & Processes
Ford Motor Co.
Dearborn, Mich.

MANY PEOPLE in a manufacturing company are concerned with materials. Their viewpoints vary widely. The designer is primarily interested that the part will function in the intended manner. A machine shop supervisor is primarily interested in materials that machine easily, a heat treat supervisor in materials that are least troublesome, and a foundryman in materials that cast well. Purchasing is interested in availability and price; a materials handling is interested in the variety of materials; salvage is interested also because they must segregate scrap to yield the most return.

Despite these concerns, there is another vital area which is often overlooked. This is the cost of materials, particularly steel. Many changes have taken place in steel pricing in the last few years. Many engineers consider the cost of steel as something that cannot be changed, except by a drastic change in requirement as from alloy to carbon steel. However, this is far from true as will be shown later. Generally, the metallurgical properties that are required of steels other than sheet, cost about 10 to 15 percent of the total price. Associated with the problem of cost is that of standardization and simplification. Gains that can be achieved are very large since an effective program eliminates or sharply reduces many operations without impairing results.

Responsibility for effecting the most efficient utilization of materials lies in the two broad areas of production engineering and manufacturing. Product engineers must be aware of latest manufacturing techniques to take advantage of reduced processing costs in design. The role of manufacturing in efficient utilization of material is varied from purchasing, handling and processing, to standardization, salvage and repair.

Ford's Specification System

Because of the necessity of releasing designs considerably ahead of production deadlines and the obviously desirable goal of releasing designs which are correct in all respects and require no change or deviation during the life of the model, it would appear that the following basic operating principle for product engineering drawings would be desirable: "Allow manufacturing all possible freedom in selecting materials and processes consistent with production of parts satisfying end product requirements."

This goal is worked out in practice by means of standards and specifications. For example, in *Fig.* 1, the material specification in the drawing calls for SAE 1020 (M-2K2-E Ford specification) steel. Referring to the substitution chart in specification M-2K2 in *Fig.* 2, it is apparent that this specification permits the use of AISI C-1023, SAE 1027, 1030, 1033, 1035 or M-2K2-F through K steels as well. With these options, manufacturing should not have to bother engineering for a deviation from metal specifications or to wait 60 days for a change to the blueprint if it is found disirable to use a substitute for SAE 1020.

With this system, since drawings do not specify detail material requirements, another means is provided for recording them. This is a "metal specification." In this, details such as sizes, tolerances, shipping instructions, packaging information and pertinent metallurgical data are given. The data contained on this sheet are used as purchasing authority when requisitions are issued. For the part in question, this specification is shown in *Fig.* 3.

Examination of this specification discloses other reasons why it is undesirable for engineering to specify too much detail. Metallurgical activities coordinating with process engineers have reviewed processing of the part. It was decided that the part should be produced on an automatic screw machine so that a free-cutting steel SAE 1119 was selected from the permitted options of M-2K2-E. Hot rolled steel was used instead of cold drawn, a silicon of 0.10 maximum is specified and special bar quality is called for. It was decided that the steel had to be pickled and machine straightened. At the time the drawing was made no one knew exactly how the part was going to be made so that it would have been impossible to specify this detail.

When present steel pricing policies, i.e., base price plus extras, were estab-

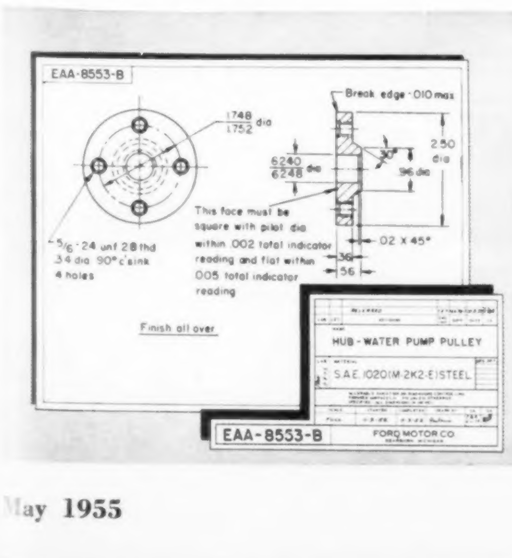


Fig. 1. Material specifications on drawings refer to company specifications, permitting use of options without drawings changes or deviations.

technical digests

lished, a manual on recommended practices was developed to standardize methods of specifying metallurgical properties throughout the company.

Thus, by means of the recommended practices manual, specification sheets and standards, close control of material costs are maintained. To cite a few instances, blueprints of Rear Spring Leaves specified the raw material SAE 5160 steel, with a maximum hardness of 300 Brinell to insure that the steel could be blanked. Material review indicated that specifying this hardness would cost a premium of $330,000 annually because of the large amount of steel required for the springs. A close study of price extra books revealed this charge could be avoided by taking a calculated risk and specifying instead of specific hardness a steel "Suitable

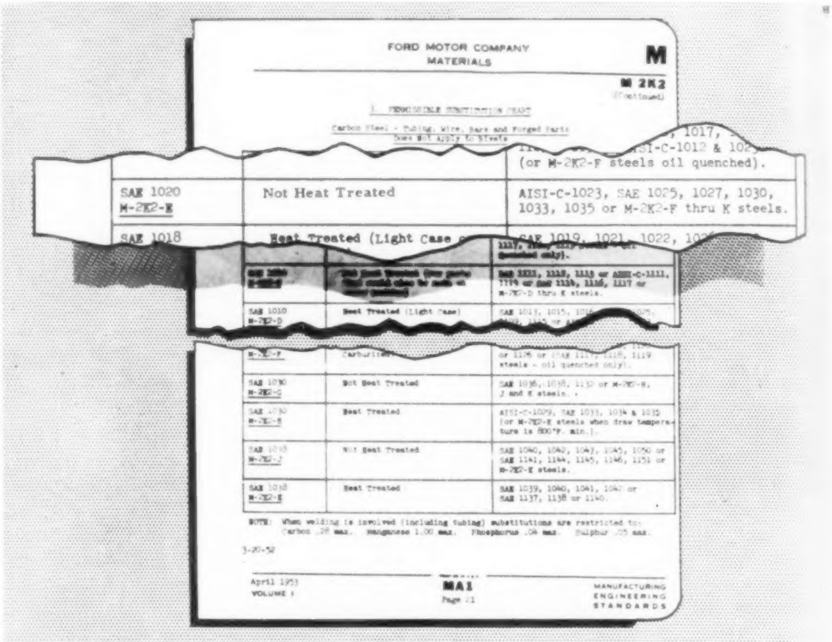
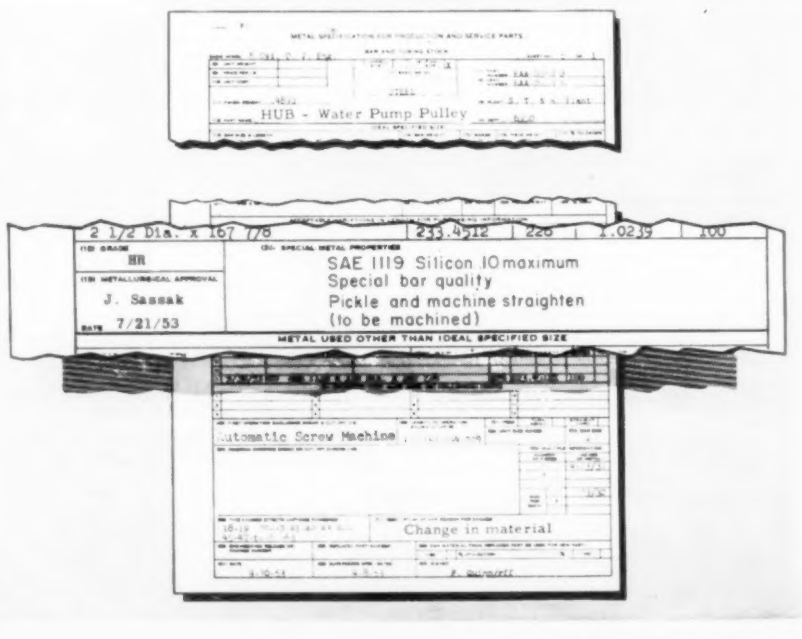


Fig. 2. Page from specification manual shows permissible substitutions for SAE 1020 steel.

Fig. 3. Metal specification sheet supplies necessary materials details with greater exactness than possible on drawing.



in Cold Shearing and Punching as Outlined in Steel Products Manual ...

In any discussion of materials management, efficient utilization of materials through standardization should play a big part. Too often, little consideration is given to this aspect of conservation.

Savings from standarization are often difficult to compute but they occur in almost all departments. Some of the most obvious beneficiaries are engineering, purchasing, materials handling and manufacturing.

In materials handling, more effective utilization of space results from reduction in inventories because of fewer items. Delivery is expedited and losses created by obsolescence are minimized.

Manufacturing becomes more familiar with materials because the variety is reduced, know-how becomes more effective, and scrap losses are lower because materials are utilized more efficiently. In addition, standardization and simplification facilitate exchange of information between departments in different locations.

A basic consideration in standardization and simplification is the use of national standards, such as SAE, ASTM or ASA, where available, or developing and using a system of company specifications instead of trade name designations. These "M"-materials as they are designated, effectively control composition and performance, permit competitive bidding, reduce cost and inventories, and promote availability. All of these work in the direction of reducing costs.

From a paper presented at the SAE production meeting and forum, Cincinnati, March 1955.

▼ ▼ ▼

Why the Trend to Automation?

By P. H. Alspach
Manufacturing Laboratory
General Electric Co.
Schenectady, N. Y.

Automation has developed as a step-by-step upgrading of our manufacturing operations. This is a progressive process that will culminate someday in the future in the automatic factory.

Today's industrial interpretation of automation is a continuous flow concept rather than the old batch concept—in other words, continuous automatic production. This interpretation covers not only the relatively limited definition of a few years ago, automatic han-

dling, but goes a great deal further to include the automatic making, inspecting, assembling, testing and packaging of parts and products in one continuous flow.

This country in the next decade will require more than double the present output. The available work force is expected to increase by only 11 percent. Even if there were enough workers to go around, no industry could afford doubling its floor space in order to double its output, without considering the additional capital investment needed for equipment and materials. The answer is increased productivity.

But how can this increased productivity be secured? By progressively mechanizing. Two main factors determine the extent to which automation may be applied today economically: volume and nature of the product. The nature of the product is considered to include the elements of product design, product standardization and materials and processes.

In product design, the designer makes use of the manufacturing process available and designs, for example, a chair to suit a particular type of manufacturing. The chair may be made by hand or with hand tools. In mechanization, plywood parts are cut and formed on machines and hand assembled. In automation a fresh approach to chair design is taken. The product is made of a new material and the chair is molded. This example points up the challenge in designing for automation, and also the fact that the extent of automation is dependent, to a large degree, upon how well design engineers meet this challenge.

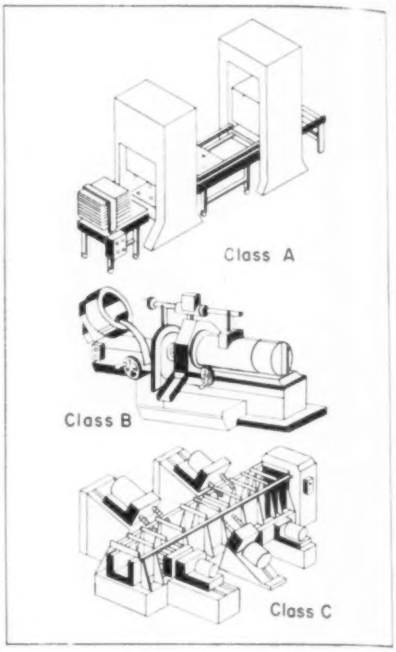


Fig. 1. Classification of automation equipment: (a) standard machines with transfer equipment added; (b) standard machines equipped with transfer mechanism; (c) special machines using standard components.

Product standardization also has great influence. Suppose six chairs are produced and each is different. Manually it is little more difficult to make them different or "special" than to make them identical, with virtually no tooling cost and production is low. In mechanization, standardization becomes important because of tooling costs and interchangeable parts. In automation standardization is of utmost importance. The chairs must all be the same, except for color and trim, as they are all made on the same tools.

Another economic factor that determines extent of automation is production volume. There is a place for automation in every business, large or small. The extent to which it can be applied economically is determined, rather than by the size of the business, by the volume and nature of the products manufactured.

In automation, material handling equipment is integrated with process equipment. Automation equipment is divided into three broad classes: (1) Standard machines with transfer equipment added, *Fig.* 1a. A large number of existing machines may be automated today by the addition of transfer equipment. (2) Standard machines equipped with transfer mechanisms, *Fig.* 1b. Many machines may be purchased today equipped with transfer mechanisms or are designed for the addition of such equipment. (3) Special machines using standard components, *Fig.* 1c. This class of equipment usu-

... is for special applications combining several operations.

The relationship between the manufacturing areas and volume and nature of the product and people and facilities is vital. It will assist managements in determining which area of manufacturing they are in, *Fig.* 2. In

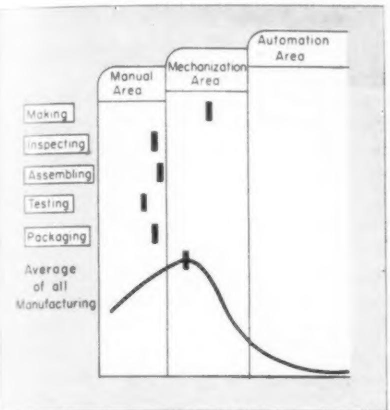


Fig. 2. Distribution of manufacturing operations and labor.

general, they will find their making operations fall in the middle or upper mechanization area, while inspection, assembly, testing and packaging might fall into the upper end of the manual area.

During the coming years the demand for higher production at lower cost will increase to a point where it will become necessary for all of industry to progress from the mechanization into automation. This will result not only from increased demands for the product, but also because the economic life of all competitive businesses is dependent upon higher production at lower cost.

The effects of automation will be felt on all functions of the business, instead of being limited to manufacturing and engineering. At first the influence will be slight, but as the continuous automatic concept is carried out the effect will become all inclusive. To be competitive in the years ahead, manufacturers must plan their automation programs today.

In progressing to automation, the combined efforts of engineering, finance, marketing, and manufacturing people are needed to build a sound program. The necessary engineering skill and knowledge, and the elements of automation are available. No longer does any doubt exist as to whether American industry will automate. Instead the question is how much and how soon?

From a paper given at the AIEE conference on machined tools, Oct. 1954.

Professionalism vs Unionization in Engineering

By Dr. G. Brooks Earnest, President
Fenn College
Cleveland, O.

In practically all instances in industry and most instances in business employing engineers, including public works, the successful operation of the organization is reflected in the creativeness, loyalty and dependability of its engineering staff. Therefore, management should assume the attitude that the engineering personnel are as much a part of management as those with business administration background and responsibility, and encourage high professional standards in this important manpower area. Management should adopt the policy of encouraging active participation in technical society affairs both through authorship of papers and attendance at national, regional and local meetings.

Management must recognize that for the first few years out of college the process of training vaults from academic to practical. There are inherent differences which should result in advancing those who have exhibited abilities to develop more quickly. The improvement of old products and development of new ones is a measure of adaptability and ingenuity of the young engineer and should be recognized along with tendencies to develop early in one's career the value of the importance of prudence.

What Is Professionalism?

Encouragement of graduate study where the man has displayed outstanding performance is a must by management. This sponsorship or even subsidy will pay dividends throughout the working life of the recipient. In addition, the engineer should be encouraged to take an active part in community, governmental, welfare, civic and church affairs. A definition of an engineer as a professional man is "one who adapts materials found in nature into a form more useful to mankind, and harnesses material forces to do man's work." It is estimated there are over 500,000 engineers in the United States. Of this number approximately 350,000 are members of technical and professional societies. About 70 percent of the 500,000 are engaged in industry, the remaining 30 percent in government and private practice. About 90 percent of all engineers are employees. Therefore, it is the employee who is largely concerned

his stake in the profession, opportunity for advancement, the appropriate use of his education and training and his personal economy.

Those who are truly professional engineers like to think they may seek and acquire success and professional status through individual initiative and creative application and extension of basic education and in turn "development." Certainlly there is no place in the professional engineer's realm of qualifications for advancement via regimentation by the collective bargaining agency which is geared to set his hourly rate of pay and control other of his working habits to a mass level.

The challenge is for members of the technical and professional societies to unitedly bear the burden of elevating the engineering profession, once and for all, to a high plane of accepted prominence among other professions. To accomplish this goal, each individual professional engineer must support with positiveness and zest his share of the load.

From a paper presented at the ASME Engineering Management Conference, Cleveland, O., March 1955.

▼ ▼ ▼

Titanium Fabrication of Tank-Automotive Components

By J. G. Stefanich
Materials Branch
Research and Development Div.
Detroit Arsenal
Center Line, Mich.

To develop fabrication know-how of titanium alloys, a development program has been developed at the Detroit Arsenal. The principal studies currently under way are primarily concerned with arc welding, forming, forging, and machining.

The welding processes studied were tungsten arc, metal arc with consummable electrode and tungsten arc with automatic wire feed.

The tungsten arc process was found to be satisfactory but slow and time-consuming. The metal arc process proved best for welding heavy plate. The tungsten arc with automatic wire feed could be used for plate up to ¼ inch.

From results of this investigation and because the metal arc process has a high current density and a high deposition rate, it was decided to use this technique for further experimental work. Restrained and unrestrained butt weld type welded specimens were pre-

pared for conducting impact tests, *Fig. 1*. These were made of a 7 percent manganese titanium alloy. Mechanical tests on this type of weld produced an average charpy V-notch impact result of 20.0 ft-lb with the charpy bar taken across the weld joint.

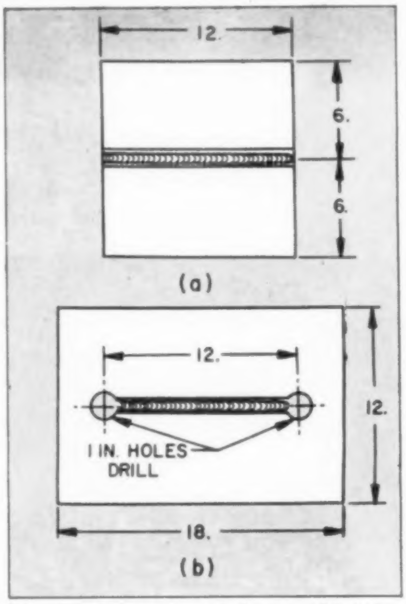


Fig. 1. Unrestrianed butt weld joint test specimen (*a*). Restrained specimen (*b*).

It soon became apparent that consideration had to be given to a technique which included preheats and postheats. Experimental tests conducted on 50-inch straight welds and circular patch welds are successful with unalloyed wire welding 7 percent manganese titanium base metal. Welds produced from similar base metal titanium alloy wire were brittle, and unsatisfactory.

Another project in this development program involves forming. Numerous experiments have been made to form tank road wheel disks having a metal thickness of ½ inch and a flange bend radius of ½ inch. Temperatures for this operation ranged from 500 to 1000 F, but all attempts to form a disk at temperatures below 900 F proved unsuccessful. Cold bend radii are formed according to military specifications MIL-T-12117 (ORD). These are shown in Table 1.

Forging presented no major problems. A number of experimental parts, such as arms and track components were successfully fabricated. Dies used for forging steel produced dimensionally larger titanium forgings because of the difference in coefficient of expansion. Temperatures below 1400 F and above 1850 F are not recommended.

Table 1—Specification Bend Radii for Titanium Metal

Class	Yield Strength psi	Bend Radius
40	40,000-55,000	1T*
50	50,000-80,000	2T
75	70,000-100,000	3T
100	100,000-130,000	3T
120	120,000-150,000	5T
150	150,000 minimum	7T

*T = Thickness of the material.

Several grades of titanium alloys have been tested for machinability. While machining of titanium alloys is quite similar to that of stainless steel, excessive carbon was found to be one of the principal causes of poor machinability due to abrasive qualities of the carbides. With caution, alloys can be machined satisfactorily under the following conditions:

1. Tools must be rigidly supported to prevent extensive vibration.
2. Sharp tools must be employed. For steady cutting, carbide tools have proved satisfactory; for intermittent, high-speed tools have been recommended. Cobalt-base, chromium carbide tools are most useful when cutting higher strength titanium metals.
3. A steady cutting feed must be used so that the tool will not ride on the work. Cutting tools should be engaged at all times for longer tool life.
4. Proper coolants must be used to minimize galling and seizing and to keep heat at a minimum.

Like other metals, titanium has its deficiencies. Further research is unlikely to produce refinements which will change physical and mechanical properties greatly. Deficiencies are briefly: Titanium is unsuited to applications involving temperatures above 800 to 1100 F; ultimate yield strength drops rapidly above temperatures of 800 F. Irreversible absorption of oxygen and nitrogen in most alloys causes brittleness and extended exposure renders the metal unfit for structural uses. Some grades have a tendency to creep and will fail under static loads. This can be eliminated by cold working. Titanium has a tendency to gall in sliding contact applications. It is not weldable to dissimilar materials. Brazing is still unsatisfactory. The modulus of elasticity is low compared with steel. Casting titanium is still impractical.

Titanium possesses an unusual combination of intrinsic properties so promising that its value as a structural material has been established.

From a paper given at the special SAE Ordnance meeting Feb. 1955.

BECAUSE *Lusol* IS DIFFERENT... WE DARE SUGGEST A SHOP-WIDE TEST!

Prove Lusol—not in just a single machine—but in a lathe, boring mill, grinder, milling machine and drill

THE DIFFERENCE—Unlike ordinary coolants, Lusol is an oil-free, all-chemical concentrate to which you add water to suit the machining operation. Water, the best coolant known, is made wetter so that it gets to the tool point and carries off heat faster. With Lusol there is no rusting, no skin irritation, no smoking to foul shop atmospheres.

YOUR BENEFITS—Superior heat dissipation means that your present equipment can be worked harder, yet your men find things easier—higher speeds and feeds, with less downtime for sharpening tools, finer finishes and closer tolerances. Improved working conditions result in better morale among your employees.

These benefits become shop-wide as your workmen recognize Lusol's advantages and ask for it in their machines.

AN OFFER—Prove to your own satisfaction—in your own plant, in your own machines—that Lusol will do all we say it does. Our field engineers will help you clean out the machines marked for the test and install Lusol in proper concentrations. Past experience in hundreds of metal working machines indicates you'll do jobs faster and better.

TO GET THIS TEST WORKING, MAIL THIS COUPON

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☐ Send me the leaflet, "Case Histories of Lusol at Work" and any other data.

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Company____________

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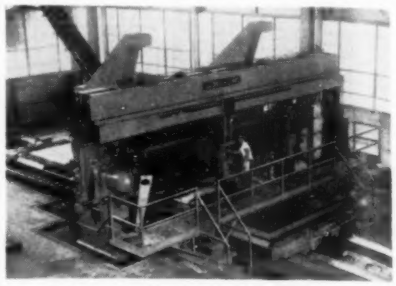
☐ Have your man call to discuss arrangements for installing Lusol All-Chemical Coolant in the machines selected for this test. ( )

Tape Controlled Milling

By H. E. Ankeney
G & L Machine Tool Co.
and
J. L. Dutcher
General Electric Co.

One of the latest developments in automatizing manufacturing operations is the practical use of tape controls in aircraft skin milling operations. A program recorded on magnetic tape directs the machine as it mills integral type stiffeners in aluminum plate stock, as shown in accompanying illustration.



Experimental milling machine installation for producing aircraft winged surfaces by tape playback controls.

The machines are planer-type milling machines which have higher feed rates than ordinary and spindles of greater horsepower and higher speeds. The workpiece is generally 75 ST aluminum. Independent, infinitely variable feed drives are provided.

The object of the record playback control system used is to reduce nonproductive time required for setup, positioning feeds, changing templates, and checking work. To make a recording, the machine is put through the motions necessary to make the desired part. As this is done, a recording is made with the machine in actual motion. Nonproductive time is not recorded. In the experimental setup, the magnetic tape controls motion of the table, crossfeed of the two heads, height of the right-hand head used in channel milling, and swiveling of the vacuum chuck mounted on the table. The tape control continuously controls their position, checking present feed position against program motions recorded on the tape. It also performs other functions that would normally be initiated by pushbuttons or limit switches.

An analysis comparing this setup with operation of a similar machine equipped with tracers and positioning devices but not record playback control indicates a 50 percent reduction in

…duction time for a typical skin pro…ed. Thus, such a machine and set… fulfill the need for faster produc…n at lower unit cost. In addition, it …minates the problem of template …rage, reduces parts inventory and …minates operator's errors. Once a …ording has been correctly made, …bsequent parts will be uniform and …rap reduced.

While recordings are necessary un…er the present setup, made by putting the machine through motions necessary to produce a part, it will be possible to make control tapes away from the machine, using numerical information from drawings. This would eliminate costly templates necessary in the method being used and would free the machine for production during time it would otherwise be used for making recordings. Many experiments are being made along this and similar lines. It seems safe to predict that such an installation will be made, and in production of aircraft parts by numerical control by the end of 1955.

From a paper presented at 7th annual AIEE conference on machine tools, Detroit, Mich., October 1954.

▼ ▼ ▼

Automation and Safety

By John B. Sterling

**Supervisor of Training,
Engine and Foundry Div.
Ford Motor Co.
Berea, Ohio**

With automation a wide variety of materials can be handled with the elimination of hazardous handling such as in large stamping, heat treat operations, forging operations and others. In many respects automation is the extended usage of conveyors.

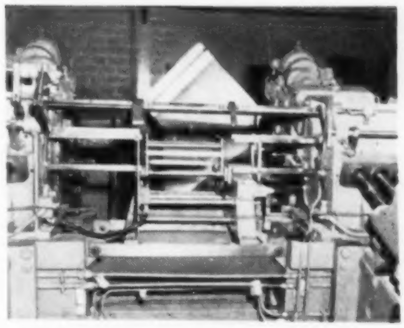
In order to fairly evaluate the effect that automation is having on the safety, it is important to consider what it accomplishes in the elimination of the well-known accident causes which are found in the nonautomated operation.

In many instances, after the initial loading of the stock into a series of in-line machines, a multiplicity of operations are performed without the need for any manual stock handling whatsoever. By comparison with former methods of single operation machines, it is obvious that the hazards associated with manual handling of stock into and out of a machine and transferring it to the next operation is almost eliminated.

Experience indicates an 85.5 percent reduction in the number of hernias in similar operations with automation.

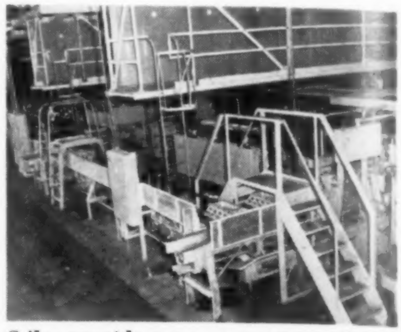
Most of the serious injuries to hands and fingers are the result of the operator exposing himself to the closing or working parts of a machine in the process of loading or unloading it. While automation has not completely solved this important problem, it is a real step in the right direction since it completely eliminates the need for repetitive exposure to point of operation.

Because of the relationship of one automated operation to another, it is highly important that a breakdown or machine failure be quickly corrected. This condition could result in the repairman inadvertently exposing himself



Steel fingers on transfer bars replace human hands in positioning parts in automation.

to working parts of the equipment. This problem has been solved by invoking a safety policy of long standing which provides that before working on a piece of moving machinery the repairman must completely de-energize the equipment by placing his personal padlock on the power source.



Stiles provide access to automated production lines.

The nature of automation dictates the generous use of stiles or cross-overs for the convenience and safety of employees in traveling from one location to another. These stiles are strategically located throughout the plant. They are not only important in terms of normal travel but serve an important purpose in emergency evacuation.

Engineers and safety personnel are constantly alert to the improvement of the design of our machines as it relates to the safety of employees. Their thinking has been passed along to our machine tool builders who have incorporated it into the design and construction of machines being built.

Automation of industrial processes is far from a completely new approach to the subject of employee safety. The same old principles still apply:

1. Engineer the hazard out of the job.
2. Guard the hazard.
3. Educate the personnel.

Safety is included in the induction of newly hired hourly personnel.

A check-off list issued by safety itemizes the coverage by the foreman and when complete the form is submitted to safety for filing. On the job a follow-up by the foreman and the safety engineer is initiated. Bulletins of unusual or new accident causes are distributed to all employees, in some cases; to supervisors only in others. A series of five-minute safety talks are given by supervision periodically to their hourly rated personnel.

A definite trend toward longer, accident-free periods through automation is evident.

From a paper given at the National Safety Congress, Chicago, Oct. 1954.

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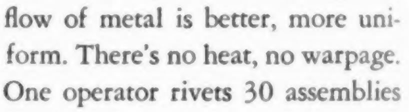

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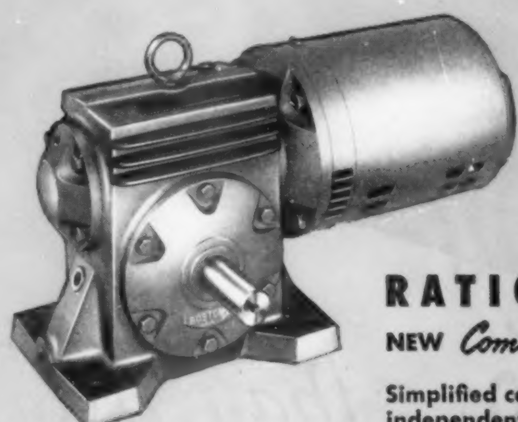

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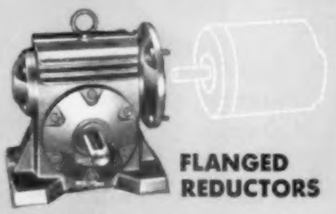

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are the reduction gear units of Ratiomotors supplied to you without motor. You buy and attach any end-mounted motor you choose. Flanged Reductors are made in the same range of models and ratings as Ratiomotors.

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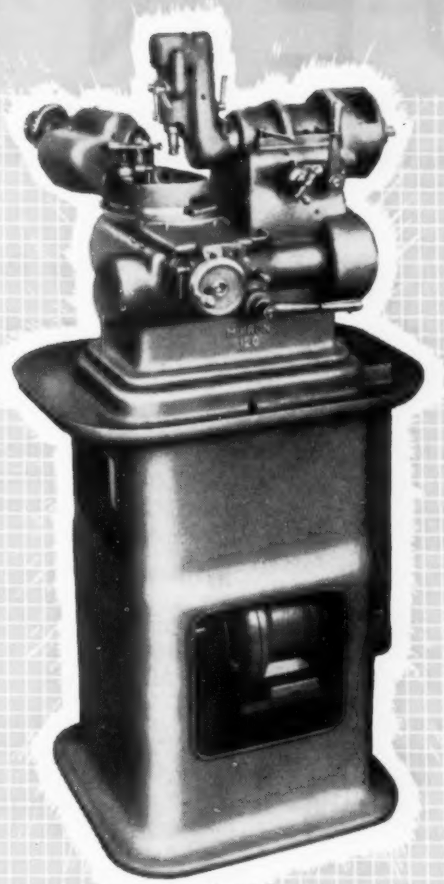

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The Keller Compression Riveter is an efficient Air Press with $1\frac{5}{8}''$ stroke and up to 10 tons compression force. It does scores of jobs better and cheaper than other equipment because it has these advantages:

CONTROLLED POWER
READY ADAPTABILITY
LESS BENCH SPACE
LOWER INITIAL COST
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It is available in two basic sizes for bench or pedestal mounting. Operates with a 3-way foot valve, or (optional) a throttle handle. So powerful it heads $\frac{1}{4}''$ steel rivets . . . but so gentle it can assemble fragile plastic parts without breakage. Ask for Catalog Section 50.

- **RIVETING**
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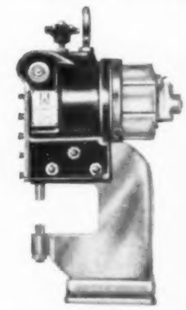
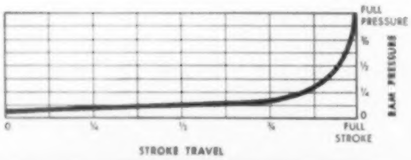


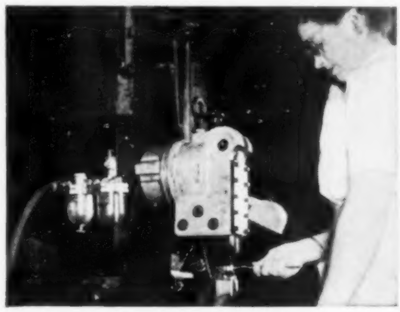
HERE IS CONTROLLED POWER



The Keller Compression Riveter delivers a squeeze—*not* a wallop! The chart at left shows how pressure builds up gradually along the length of the stroke, attaining maximum only at the very end. This gradual build-up of pressure avoids delivering a sharp impact which might distort small parts, or shatter fragile ones.

Assembling fragile plastic parts

Staking pins in electron tubes



Swaging small metal parts

KELLER TOOL

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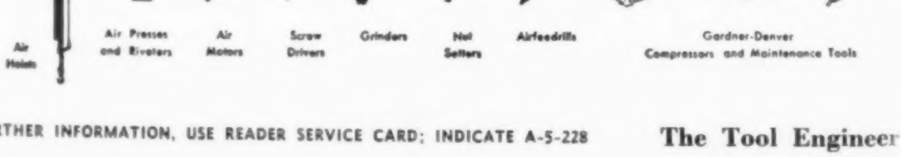

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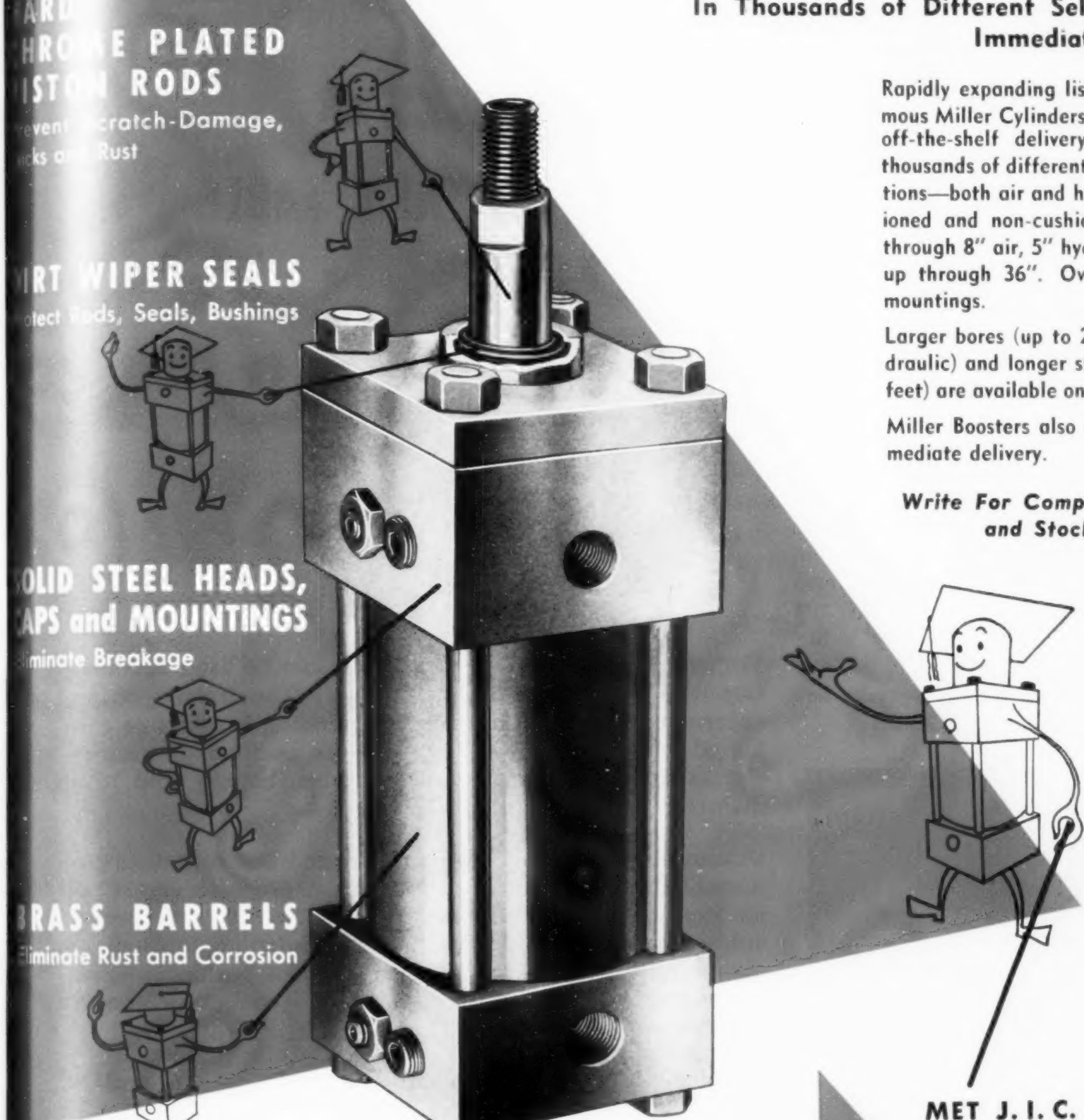

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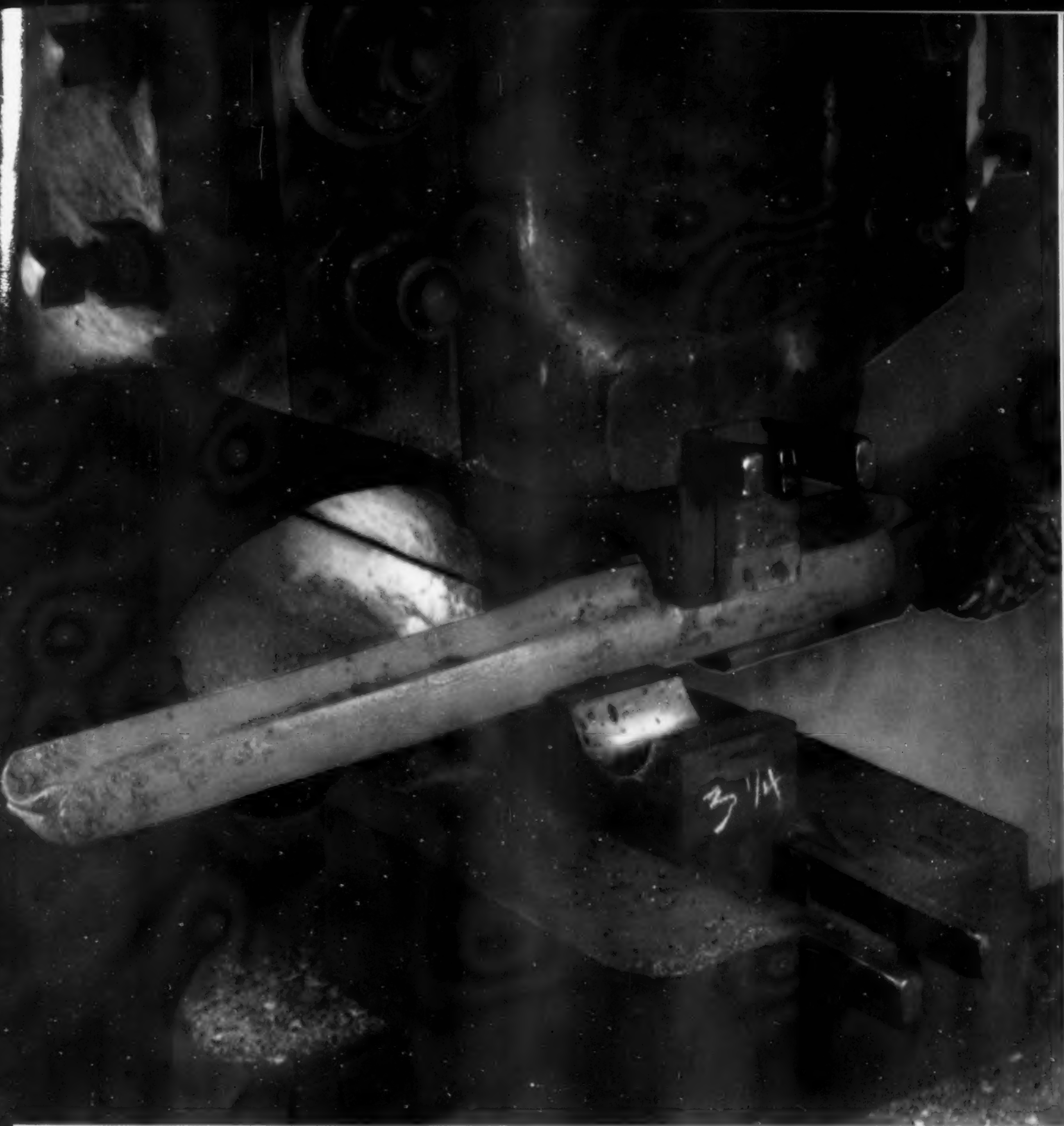

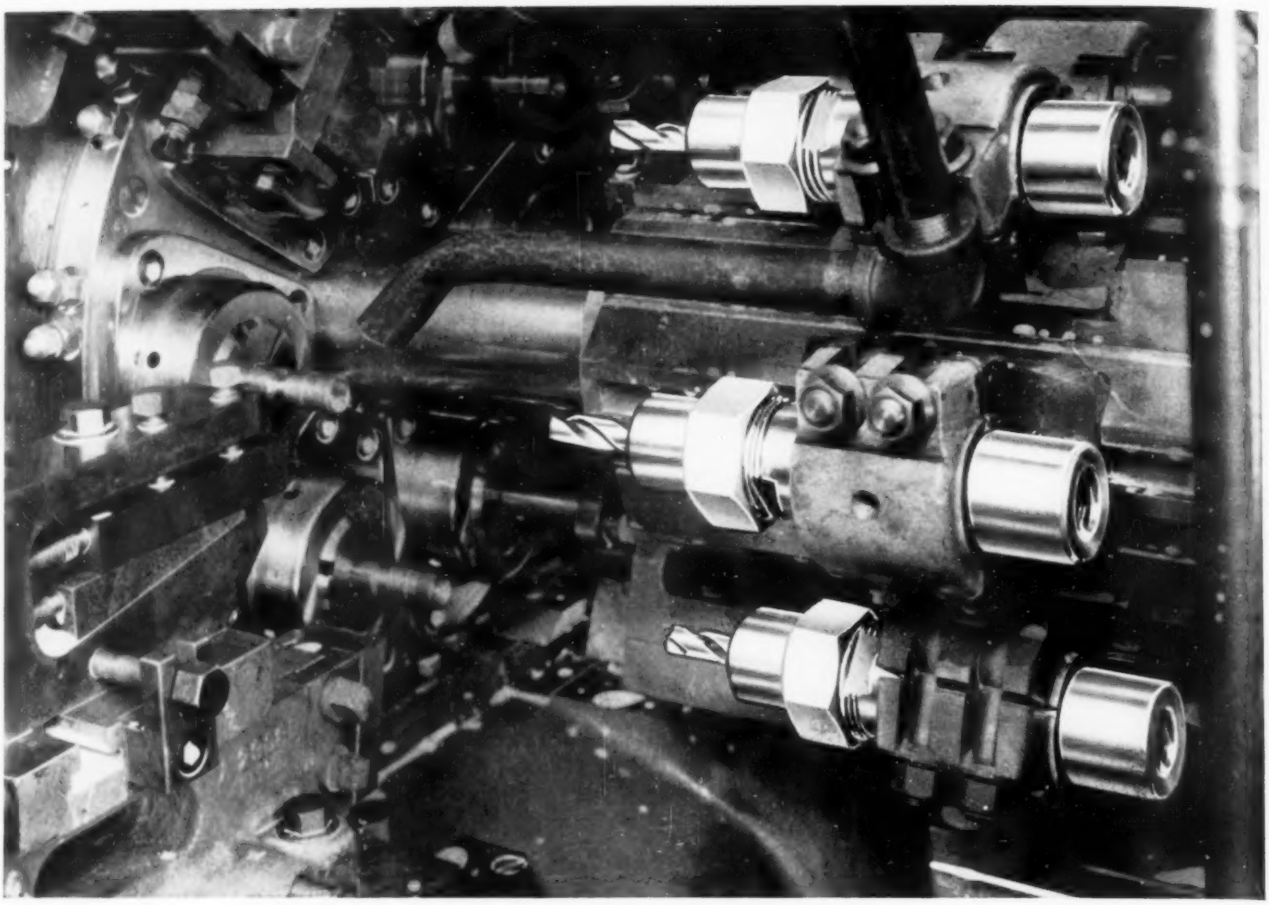

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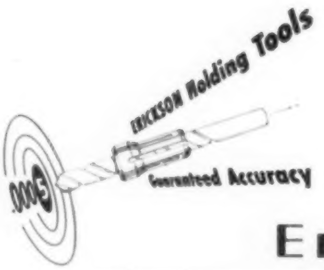

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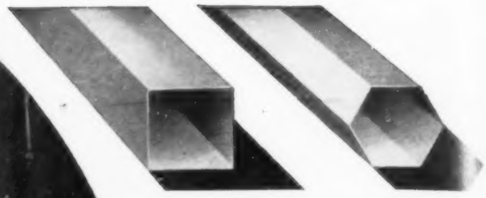
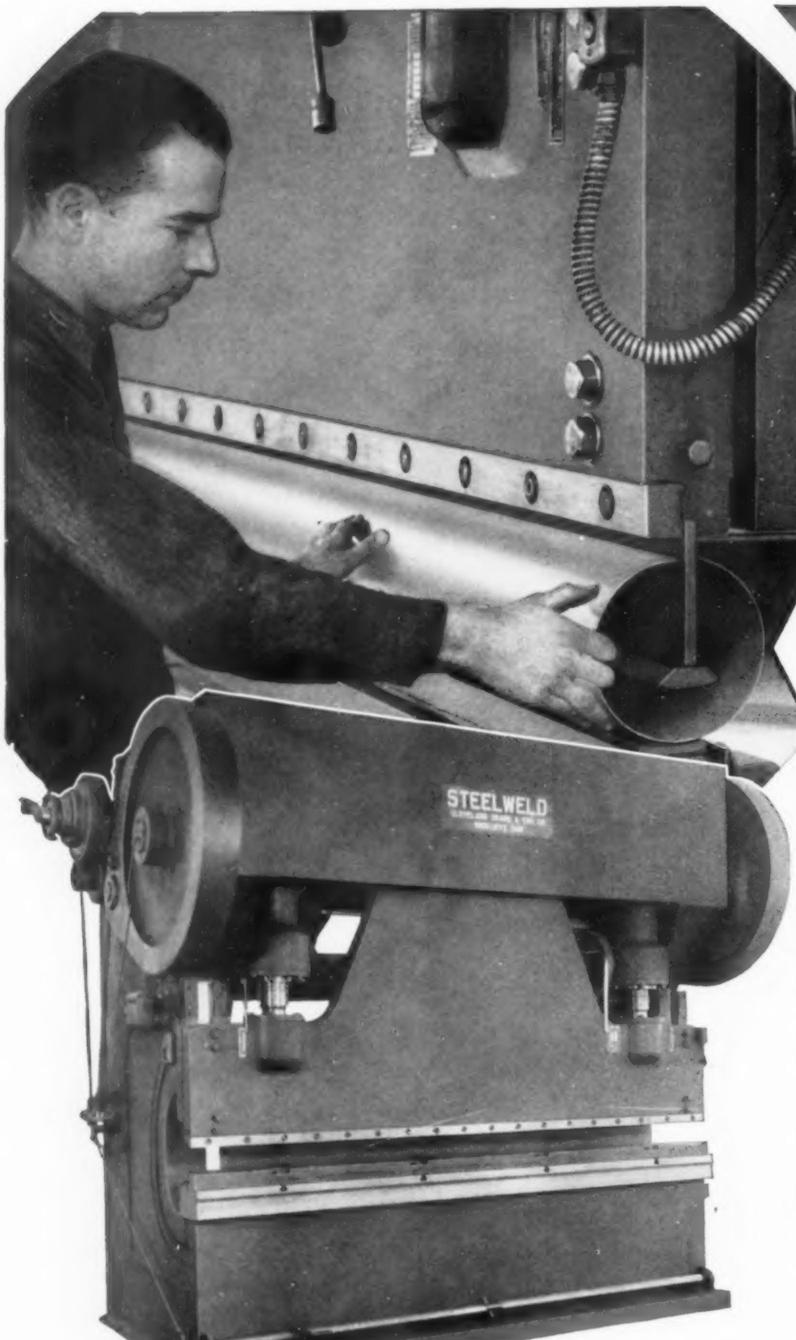


Forming a 6-inch diameter cylinder on a Steelweld Press. Machines can be furnished for forming cylinders in lengths up to 20 feet.



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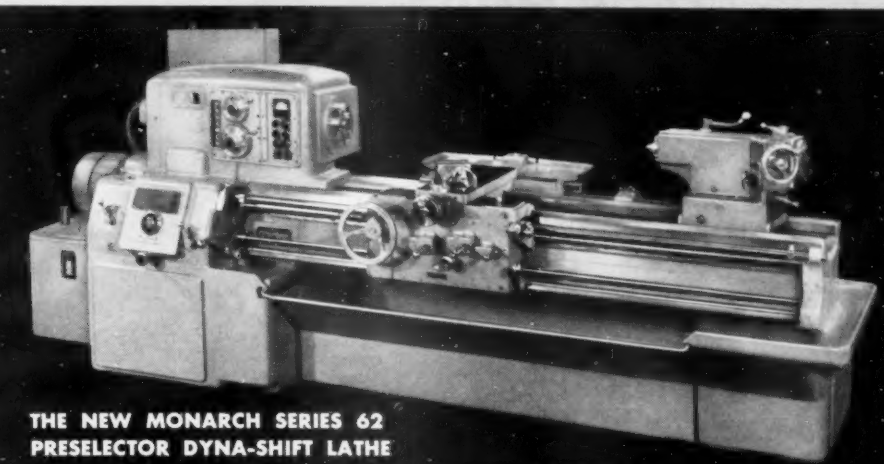

THE NEW MONARCH SERIES 62 PRESELECTOR DYNA-SHIFT LATHE

Models 130 and 1130 (above)—13" swing over cross slide, 20" clearance diameter.
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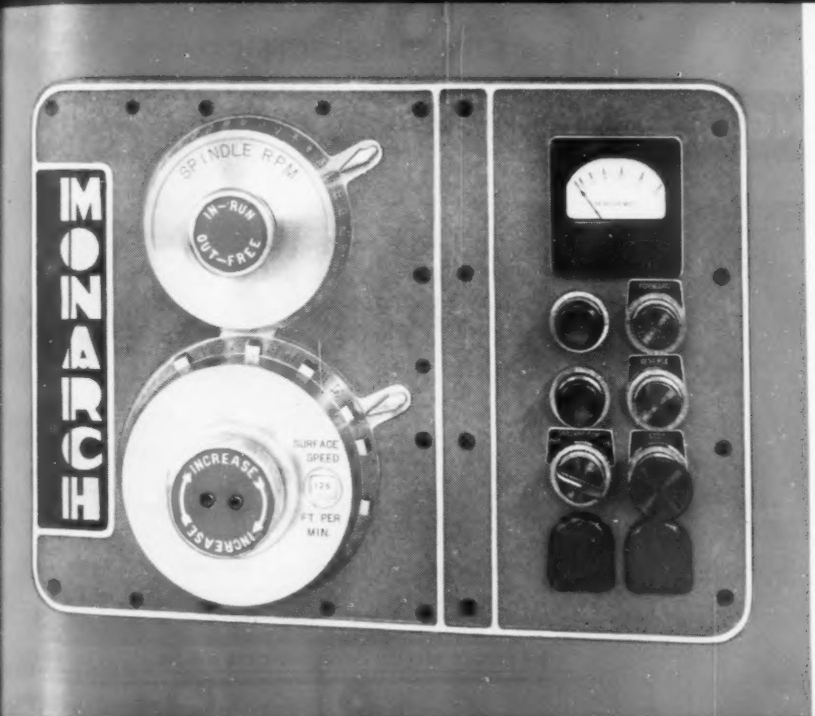

Set it—forget it! That's the story of the Preselector Dyna-Shift. It's the brain Monarch has built into the new Series 62. With it *this* machine will give a greater ratio of metal removing hours to work hours than you ever dreamed possible.

When setting up, merely dial the surface speed wanted and the first diameter to be turned—the Dyna-Shift computes the R.P.M. and makes the shift instantaneously and automatically. *(Time-saver #1)*. Then, to maintain this surface speed on successive diameters, set the work diameter selectors. Every speed change thereafter, on *every* piece in the run, takes place automatically with but one fast dial setting and movement of the work start and stop lever. *(Time-saver #2)*. What's more, here at last is the lathe with a speed range so wide as to take care of all your needs. Its 20 H.P. drive gives you 36 different spindle speeds in a range from 14 to 1750 R.P.M., a ratio of 1 to 125. *(Time-saver #3)*.

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You will want to know all about these and many other features in detail. Send the coupon for the greatest turning news in years ! ! . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

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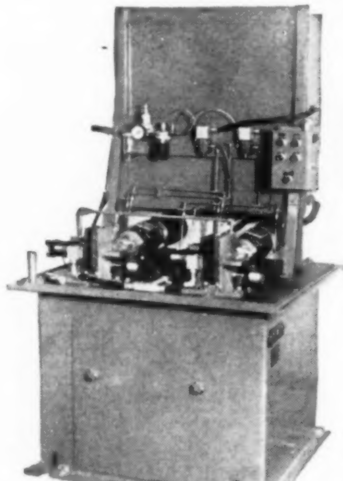

Drilling at a higher production rate and a lower production cost is the result achieved by applying the principles of automation in the designing of this new Govro-Nelson Automatic Drilling Machine for drilling a .135 hole in a brass part.

The machine incorporates two independent Govro-Nelson Automatic Drilling Units, each being completely interlocked with an air-operated magazine which is kept filled by the operator or mechanically.

The parts are automatically clamped, drilled and ejected into a chute, permitting complete automation. Output rate: 40 pieces per minute.

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USE READER SERVICE CARD; INDICATE A-5-240-3

KEYLESS DRILL CHUCKS

SLIP-PROOF

STRONGEST CHUCK MADE

TRY ONE

K. O. LEE CO.
ABERDEEN, S. D.

If it's made by **Lee** *it's a* **"Knock-Out"**

USE READER SERVICE CARD; INDICATE A-5-240-4

NOW IS THE TIME . . .

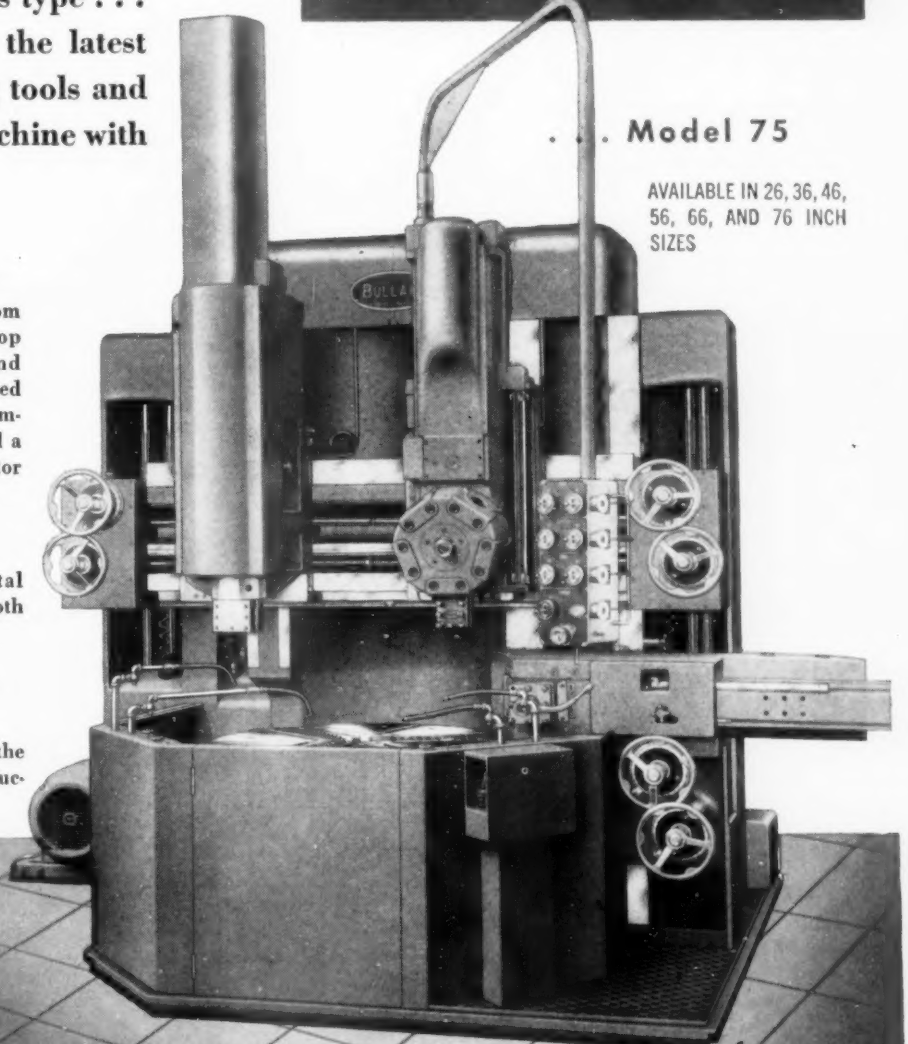
and here is the way!

To Reduce Manufacturing Costs with a . . .

SEVENTY FIFTH BULLARD ANNIVERSARY

CUT MASTER
VERTICAL TURRET LATHE

This revolutionary new design of vertical turret lathe has exclusive features never before offered on machines of this type . . . takes full advantage of the latest improvements in cutting tools and methods . . . truly the machine with a "built-in" future.



. . . Model 75

AVAILABLE IN 26, 36, 46, 56, 66, AND 76 INCH SIZES

PENDANT CONTROL . . .

provides maximum machine control from a movable pendant station. Start and stop spindle; selection of speeds, feeds and directional movement of all heads in feed or traverse are quickly and easily accomplished from the Pendant. Interlocks and a stopall stick provide safety for both operator and machine.

SCREW FEED . . .

is provided for vertical and horizontal motion of all heads—to assure fine, smooth finishes with greater accuracy.

POWER INDEXED MAIN TURRET . . .

(Optional) Five sided turret for "run of the mill" jobs. Four sided turret for production jobs.

PLAN TO SEE OUR EXHIBIT AT . . . .

WE INVITE YOUR INQUIRIES—CALL OR WRITE YOUR NEAREST BULLARD SALES OFFICE, DISTRIBUTOR OR

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

MBI

• greater production
• lower costs
• smaller investment

PRECISION DESIGNED AND BUILT TO MEET THE REQUIREMENTS OF THE AGE OF AUTOMATION

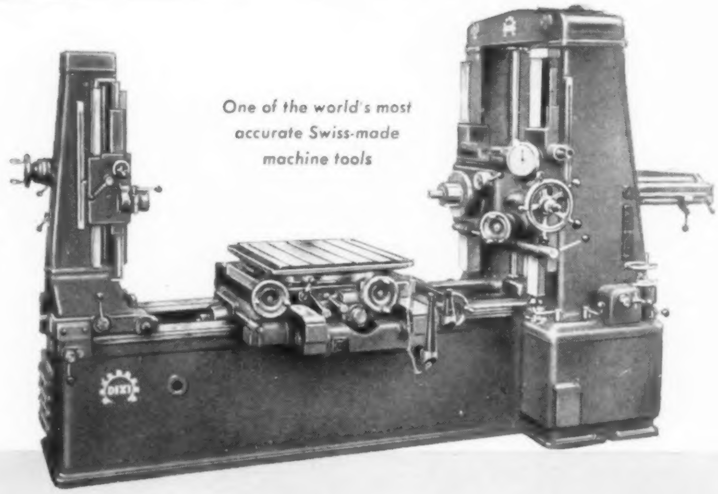
Dixi 60 Combination

Horizontal Boring Mill & Jig Borer

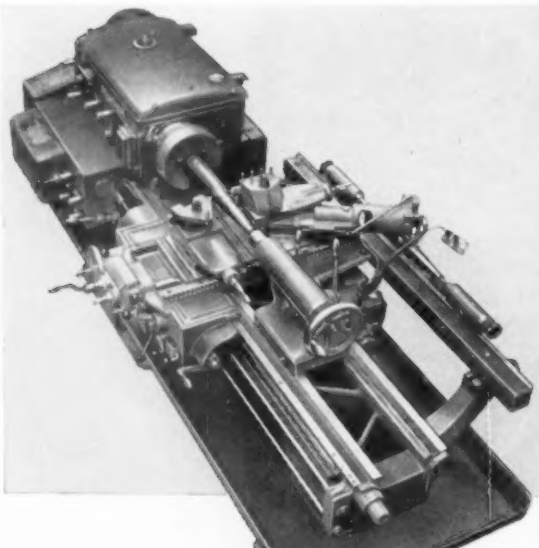
With 5 optical microscopes

A precision machine for boring, drilling, recessing, and milling work. Built-in rotary table with optical microscope can be rotated 360°. Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Table and spindle head have variable hydraulic feed. Mechanical spindle feed can be changed without stopping spindle and is provided with automatic depth stop.

No. 40 taper spindle. Spindle speeds 32-1350 R.P.M. Feeds .0015"—.010" per rev. Table size 28¾" x 32⅝" max. distance spindle to table 19¾". Table travel 23⅝". Spindle travel 24.4".



One of the world's most accurate Swiss-made machine tools



Heavy Duty Lathe *High Precision, Reliability, Top Performance Schaerer Model UN-450*

Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permit rough turning and finish turning in the same operation in many instances. Swings 17¾" over bed, 9" over carriage, 20-5/64" over gap. Center distance 60". Spindle speeds 31.5 to 1400 R.P.M.

Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pump. A production lathe built to tool room standards.

Write for complete details and prices to Dept. 21

M.B.I. EXPORT & IMPORT LTD.

A Division of Machinery Builders Inc.
475 Grand Concourse, Bronx 51, N. Y.
"Over 20 years experience in designing & building machinery"
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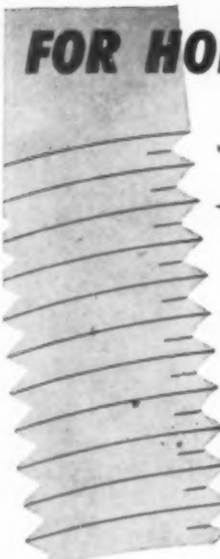
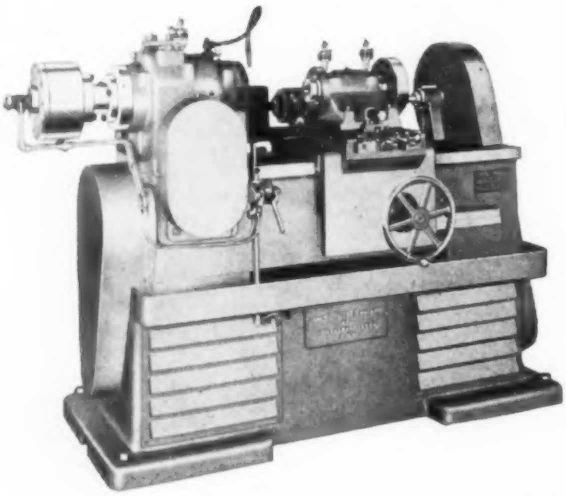
Our Headquarters in New York City

FOR HOB THREADING:



- NON FERROUS METALS
  ...YOU NEED **HIGH SPEED!**
- HEAT TREATED MATERIALS
  ...YOU NEED **LOW SPEED!**
- VERY SHORT RUNS
  ...YOU NEED **QUICK CHANGEOVERS!**

ONLY THE COULTER "H1" GIVES **ALL THREE!**



Yes sir, the COULTER "H1" Hob Thread Milling Machine is the only completely automatic machine that has such outstanding exclusive features for producing precision internal and external right-hand and left-hand threads — *ON A PRODUCTION BASIS!*

In addition, it's (a) fully **AUTOMATIC**, (b) works equally well with universal or air operated chucks, or, special fixtures, (c) has work spindle with an extra large hole, (d) work can be inserted from face to rear end, (e) has pick-off gears and an adjustable sheave drive. ***It's the machine for you!***

EXTRA *For Brass, Aluminum and Steel.* The "H1" makes provision for a separate motor to give the cutter and work spindle a larger range of speeds and feeds for threading these materials.

Send for complete information on the "H1" and other Coulter Automatic Threading Machines — no obligation.

MACHINE TOOL BUILDERS SINCE 1896

The James Coulter Machine Co.

645 Railroad Ave. Bridgeport 5, Conn.

USE READER SERVICE CARD; INDICATE A-5-244-1

USE READER SERVICE CARD; INDICATE A-5-244-2

PAT. 2,678,500

Automatic Size Control for Cylindrical Grinding Machines

- ***INCREASE PRODUCTION!***

Reduce scrap. Improve quality on your cylindrical grinding operations.

The Model 229-ABD Foster "ELECTROSIZER" Gage illustrated, sizes the work during the actual grinding operation.

It features: Automatic dwell control ahead of finished size.
Automatic retraction of wheelslide at finished size.

For the first time an automatic gage which can be used to accurately grind splines or interrupted surfaces.

Write for our complete catalog of grinding gages.

FOSTER ENGINEERING CORP.
4200 WOODWARD AVENUE • ROYAL OAK, MICHIGAN

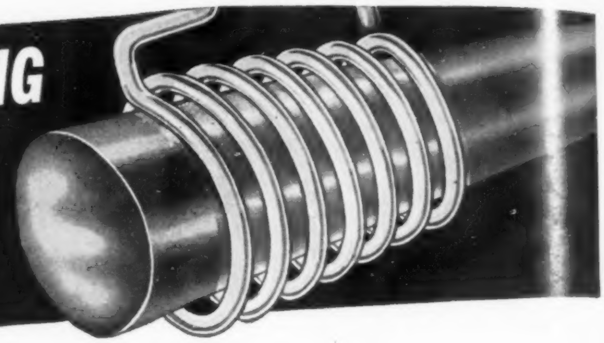
USE READER SERVICE CARD; INDICATE A-5-244-3


BUTTERFIELD
BUTTERFIELD
1
NSC
A COMPLETE LINE OF QUALITY cutting tools is now available from your Butterfield distributor. Reamers are made to the same exacting standards as Butterfield Taps, Dies, Milling Cutters, Drills, Counterbores and End Mills.
UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U.S.A.
FOR FAST, ECONOMICAL SERVICE
CALL YOUR BUTTERFIELD
DISTRIBUTOR

YOU CAN HEAT *ANYTHING*

FROM A NEEDLE . . . TO A TURBINE SHAFT

FASTER and BETTER



WITH *Lepel*

HIGH FREQUENCY
Induction
HEATING UNITS

BRAZING
Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

HARDENING
Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.

SOLDERING
Speedily and neatly performs intricate soldering applications with or without the use of preformed rings.

ANNEALING
Ideal for annealing, stress-relieving, normalizing or preheating selected areas.

MELTING
Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

2½ KW INDUCTION HEATING UNIT

30 KW INDUCTION HEATING UNIT

100 KW INDUCTION HEATING UNIT

LEPEL Electronic Tube GENERATORS
1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

LEPEL Spark Gap Converters
2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

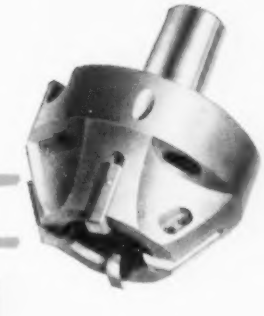
WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information on high frequency induction heating.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

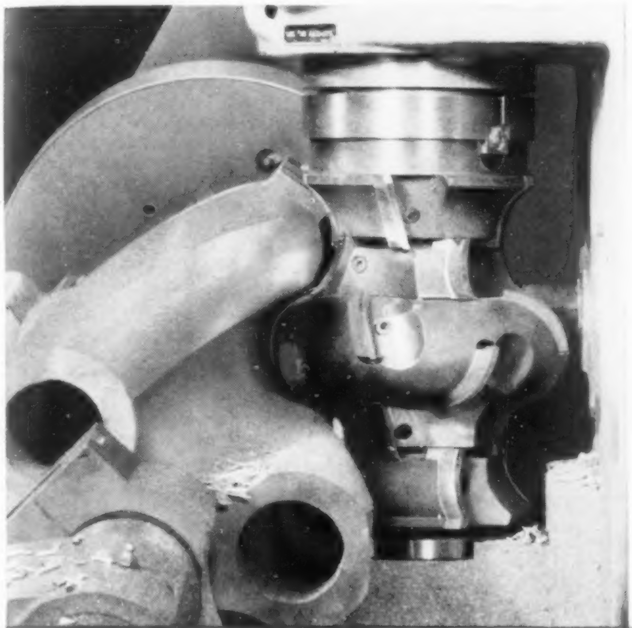
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-246

INGERSOLL

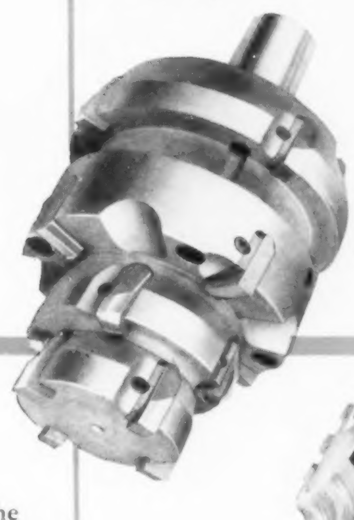
Special Cutters



Greater Economy by Combining Multiple Operations in One Pass



In one pass, a gang of five specially designed Ingersoll roughing cutters with carbide-tipped blades completely machines lobe of diesel locomotive blower rotor.

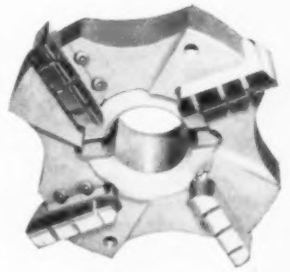


Ingersoll Special Cutters are individually designed to meet the exact requirements of many complex milling and boring operations. For performance and economy, these cutting tools have low-cost replacement blades and are designed to permit use of cutter gangs or combination tools to do several operations in one pass.

While Ingersoll produces a wide variety of standard inserted blade milling and boring cutters, the design and manufacture of special cutters is a substantial part of the company's business. Ingersoll offers you the benefits of modern, efficient production equipment and 65 years of experience in building good cutters economically.

Ingersoll cutter engineers will study details of your work and recommend Special Cutters to answer your specific production needs.

Write for Catalog 60F describing Ingersoll inserted blade special cutters, the complete line of standard cutters and recommended cutter grinds.



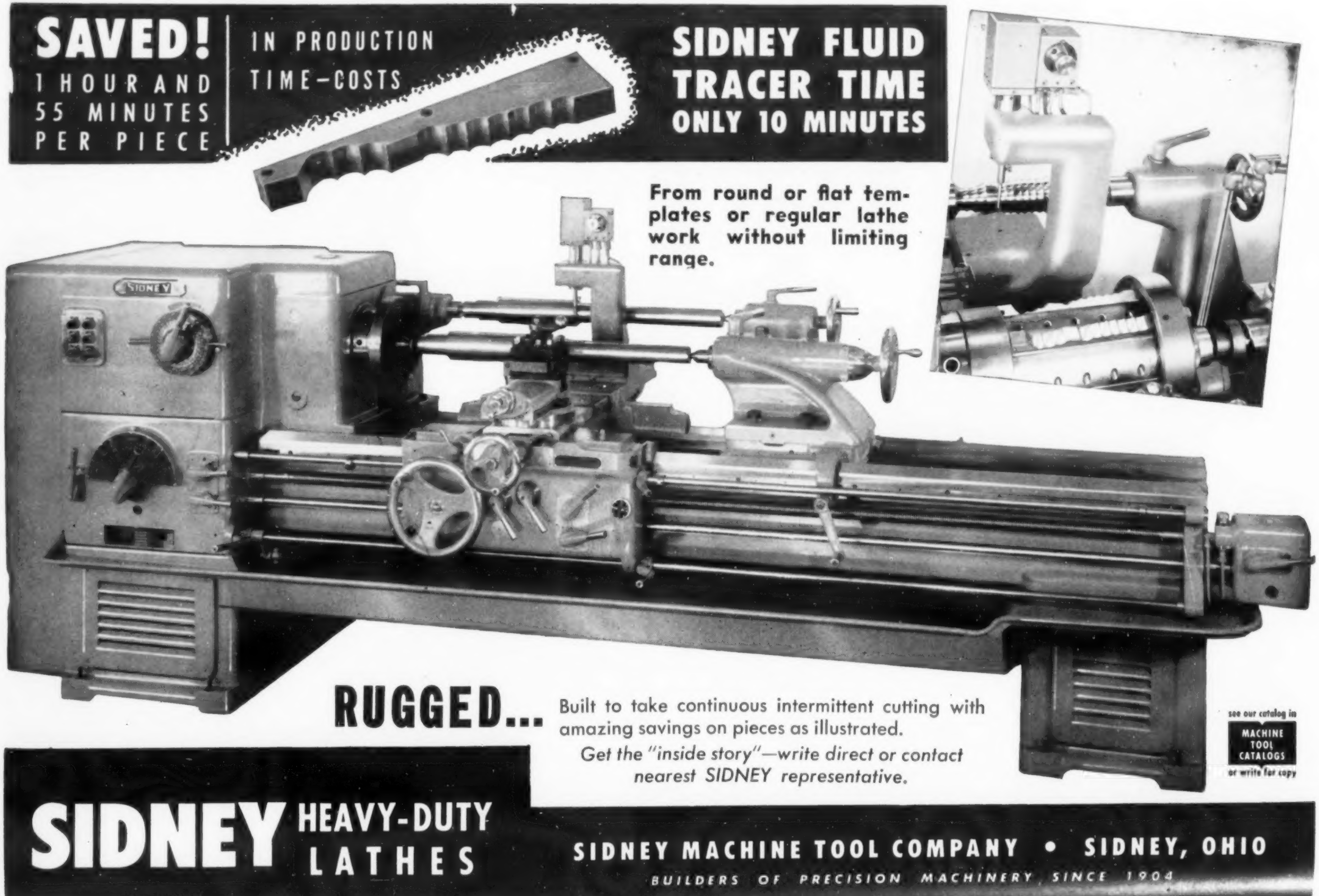
THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD, ILLINOIS, U.S.A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

ORIGINATORS OF SHEAR CLEAR CUTTERS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-247


SAVED!
1 HOUR AND
55 MINUTES
PER PIECE
IN PRODUCTION
TIME—COSTS
SIDNEY FLUID
TRACER TIME
ONLY 10 MINUTES
From round or flat templates or regular lathe work without limiting range.
SIDNEY
RUGGED...
Built to take continuous intermittent cutting with amazing savings on pieces as illustrated.
Get the "inside story"—write direct or contact nearest SIDNEY representative.
see our catalog in
MACHINE
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or write for copy
SIDNEY HEAVY-DUTY
LATHES
SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO
BUILDERS OF PRECISION MACHINERY SINCE 1904

We're Looking for Head Hunters!....

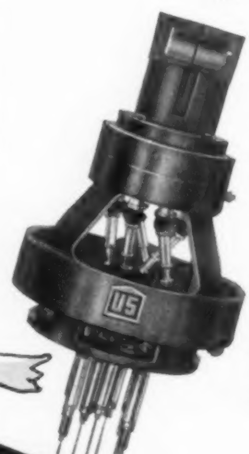
Most machine tool men have long relied upon the "US" Adjustable Multiple Spindle Drill Heads. But we are looking for those who still haven't tried them . . . and who are looking for the best.

With their quick-change universal joint assemblies, they are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating. All gears are hardened and shaved with spindles superfinished.

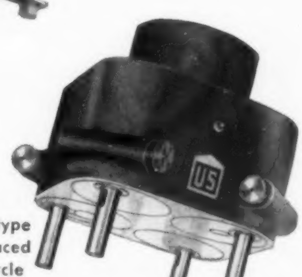
The single eccentric type is used for equally spaced holes on bolt circles.

The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.

Double eccentric type for irregular spacing



Universal joint with slip spindle fixed locating plate

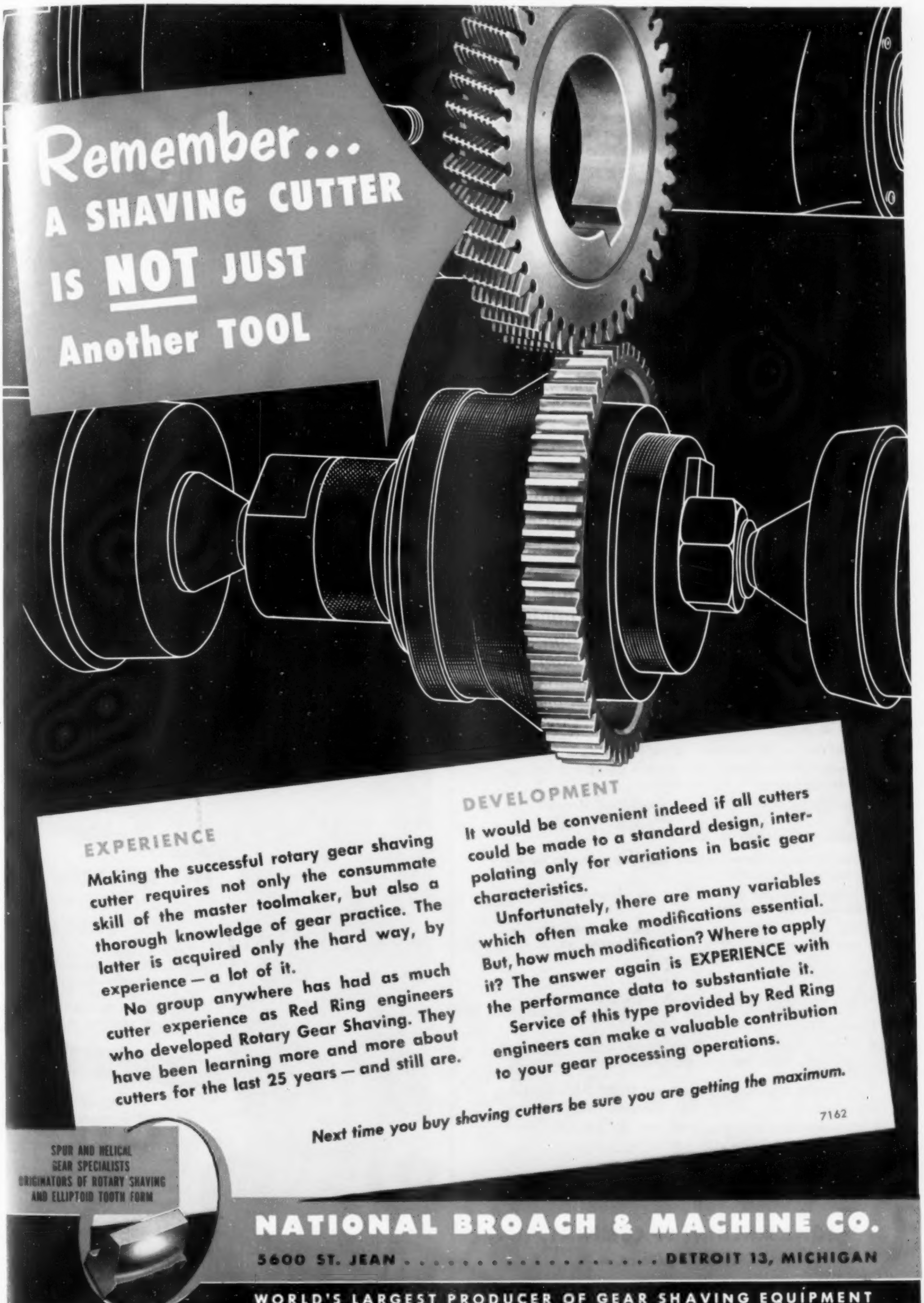


Single eccentric type for equally spaced holes on bolt circle

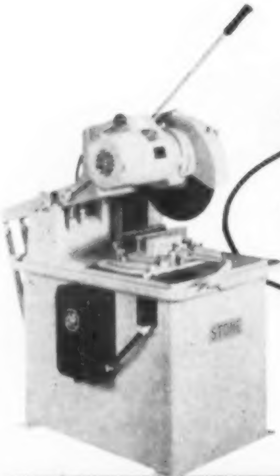
Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD COMPANY

616-618 BURNS STREET • CINCINNATI 4, OHIO



Remember...
A SHAVING CUTTER
IS NOT JUST
Another TOOL
EXPERIENCE
Making the successful rotary gear shaving cutter requires not only the consummate skill of the master toolmaker, but also a thorough knowledge of gear practice. The latter is acquired only the hard way, by experience — a lot of it.
No group anywhere has had as much cutter experience as Red Ring engineers who developed Rotary Gear Shaving. They have been learning more and more about cutters for the last 25 years — and still are.
DEVELOPMENT
It would be convenient indeed if all cutters could be made to a standard design, interpolating only for variations in basic gear characteristics.
Unfortunately, there are many variables which often make modifications essential. But, how much modification? Where to apply it? The answer again is EXPERIENCE with the performance data to substantiate it.
Service of this type provided by Red Ring engineers can make a valuable contribution to your gear processing operations.
Next time you buy shaving cutters be sure you are getting the maximum.
7162
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM
NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN . . . . DETROIT 13, MICHIGAN
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



MODEL M75
*"Heavy-Duty" cut-off machine.
Capacity: 2½" solids, 4" pipe and structurals.*

Cuts hardened tool steel Increased production over 5 TIMES*

A large Detroit tool shop formerly teamed a power hack saw with a band saw for cutting hardened tool steel.

These two machines were replaced by a single model M75 cut-off machine. *Result.... Model M75 increased production over 5 times. Cost data proves tremendous economy of Stone machines compared to other methods.

- Cuts any metal — ferrous or non-ferrous—in 2 to 4 seconds per sq. inch.
- Used for cutting bar stock, pipe, tubing, structurals, etc.
- Leaves milled-like finish with tolerance less than ±.005; reduces the need for further machining.
- No change of characteristics or hardening of stock.

EXCLUSIVE FEATURES BY STONE

- Geared-in-head motor delivers maximum power to cutting edge for greatest efficiency.
- Self-centering vise presents least arc of contact for faster cutting, longer wheel life.
- Vise plate calibrated in degrees permits speedy changeover from straight cutting to angular cutting up to 46°.

OPTIONAL FEATURES

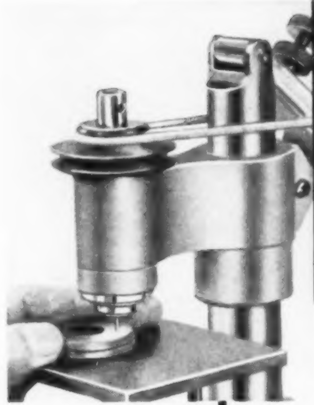
- Semi-Automatic Power Stroke provides simpler operation, minimizes operator fatigue; gives up to 25% longer wheel life.
- Oil Mist Spray attachment for cooler, easier cutting increases saw blade life up to 400% on non-ferrous materials.

Get profit-making equipment from Stone. Our representatives will gladly discuss your cutting requirements without cost or obligation. Just write or phone.

"Cut-off machinery by Stone . . . represented in every major industry throughout the world."

STONE MACHINERY COMPANY, INC.
31 FAYETTE ST., MANLIUS, N. Y.

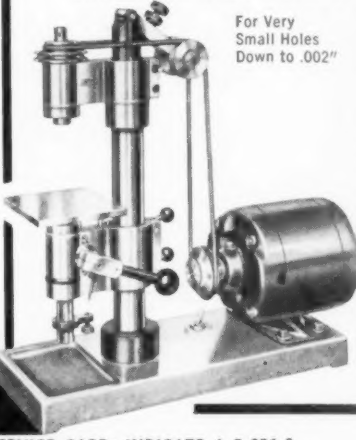
USE READER SERVICE CARD; INDICATE A-5-256-1



SMALL DRILLS MUST BE HELD IN PRECISION COLLETS TO ASSURE ACCURACY

LEVIN

MICRO-DRILL PRESS



Designed to hold small drills in precision collets, thus overcoming the difficulty of making a drill run true as when held in a conventional drill chuck. Absence of a sliding quill guarantees maximum sensitivity with fingertip control. A mounted ⅛" capacity chuck can also be used.

Send for Catalog "M" describing Micro-Drill Press, full range of collet sizes, Micro-Drills, accessories and other precision tools.

LOUIS LEVIN & SON, INC.
3610 S. Broadway
Los Angeles 7, Calif.

USE READER SERVICE CARD; INDICATE A-5-256-2

PEECO.. the BIG NAME in SMALL PARTS FEEDING

THE REASON...
...ENGINEERED CAST BOWLS

PEECO approaches each small parts feeding problem from an engineering standpoint. Peeco cast hopper bowls are specially designed to meet specific needs.

"OPERATION AUTOMATION"

PEECO single and multi-track bowls are accurately machined to give you perfect timing, proper position and careful handling of small parts. If parts feeding is impairing your profits, put the problem up to Peeco. Write, or phone.

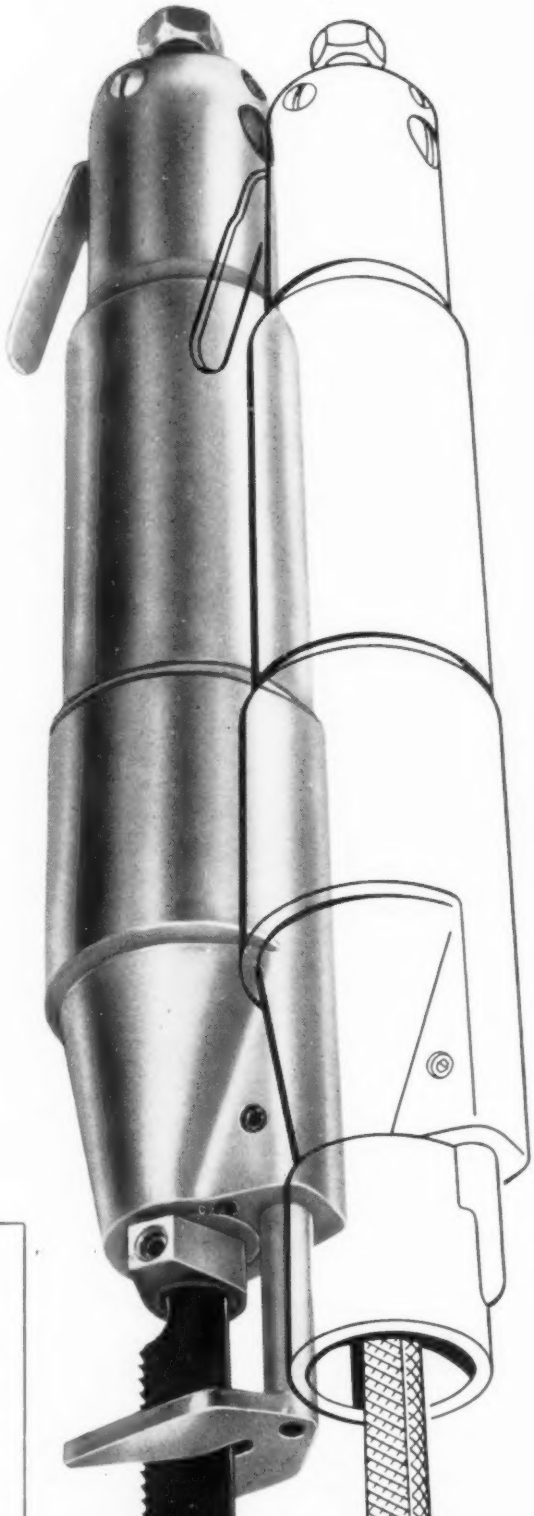
Peeco

PERRY EQUIPMENT & ENGINEERING CO.
3125 BRANDES ST., ERIE, PA.

USE READER SERVICE CARD; INDICATE A-5-256-3

NEW!

the double-duty CP Air Saw



IT CUTS AND FILES . . .

Stainless Steel, Dural Alloys, Nickel, Copper, Aluminum, Iron, Steel, Brass, Plastics, Plexiglass, Fiberglass, Porcelain, Formica, Corrugated Transite Sheeting, Wood, Plywood, Hard Fibre, Wall Board, Masonite.

The CP Air Saw is not an attachment . . . it's a heavy-duty production tool that can take standard blades and files. The Chicago Pneumatic Saw has CONTROLLABLE POWER . . . a built-in speed regulator enables you to select the right speed for every specific work condition. When fitted with the blade collet it can saw practically every material and cut most any possible shape . . . a file chuck can be added to power bench files having round or flat shanks. *Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y.*

EXAMPLES OF ITS THOUSAND-AND-ONE USES

1. **In Receiving and Shipping** — for opening wooden boxes and crates.
2. **In the Shop** — for cutting through thin gauge metal without resulting warpage.
3. **In the Foundry** — for deburring castings.
4. **In the Automotive field** — for installing car heaters, radios and many other "extra" items.
5. **In the Electrical field** — for armature undercutting, cutting coils out of electric motors prior to rewinding, for filing burrs from stator slots in motors and generators.
6. **In Plant Maintenance Departments** — for blind sawing in duct and piping work.

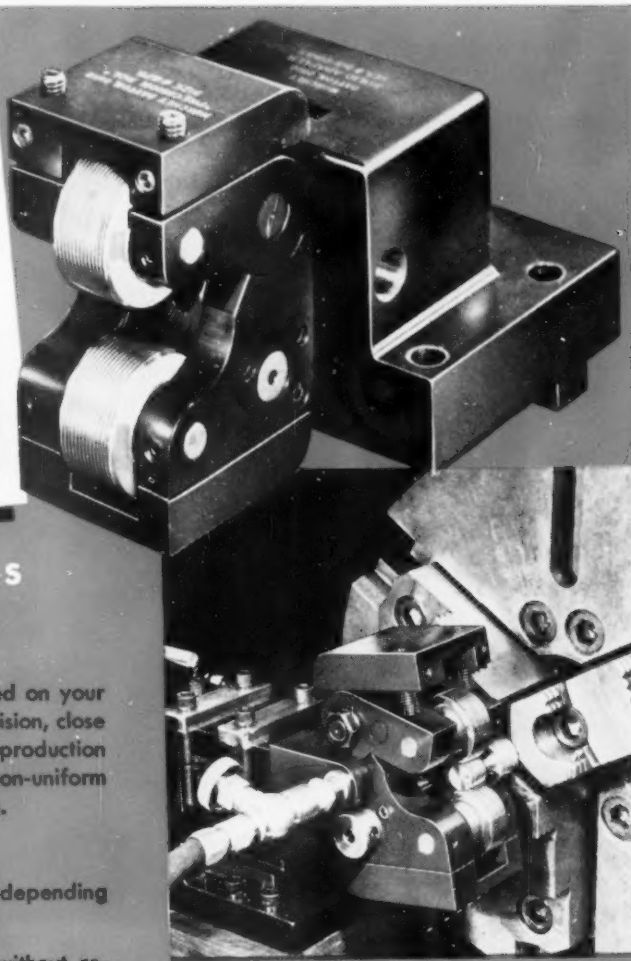
CP

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-258

Roll THOSE THREADS for STRENGTH, ACCURACY and Overall ECONOMY *on the* Precision-Rol



EXCLUSIVE ADVANTAGES

- Just one adjustment for precision matching of rolls
- Just two adjustments to precisely set pitch diameter

The Sheffield-Murchey Precision-Rol attachment mounted on your automatic screw machine or turret lathe, rolls high precision, close tolerance uniform threads, right or left hand, at mass production rates. Annular or helical grooves, taper threads and non-uniform starts can be produced—also knurling and burnishing.

GEARING—All gearing TOTALLY ENCLOSED

ROLL LIFE—In excess of 100,000 work pieces, depending on material rolled—some jobs as high as 350,000

ROLL TIMING—Timing and adjustment of rolls without removal from the machine

Precision-Rol produces smooth finish threads with accurate lead.

Write for Bulletin MU-PR454. ***Murchey Division, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.***

ACTUAL THREAD ROLLING CYCLES OBTAINED WITH PRECISION-ROL

PART	MATERIAL	THREAD	CYCLE TIME
TUBE FITTING	Aluminum	7/16—20 N.F.	3 Sec.
LOCK SCREW	4140 Steel	7/16—14 N.C.	5 Sec.
TUBE FITTING	Brass	7/16—20 N.F.	3 Sec.
STOP SCREW	4140 Steel	5/16—24 N.F.	5 Sec.
SPARK PLUG	Steel	3/4—20 N.F.	4 Sec.

See us at the Machine Tool Show, Booth 1305

CAPACITIES OF STANDARD UNITS*

Attachment Number	Thread Diameter	Roll Face
437	0 to 7/16	53/64
875	1/4 to 7/8	53/64
1125	3/8 to 1 1/8	1 1/4
1500	3/4 to 1 1/2	1 1/2

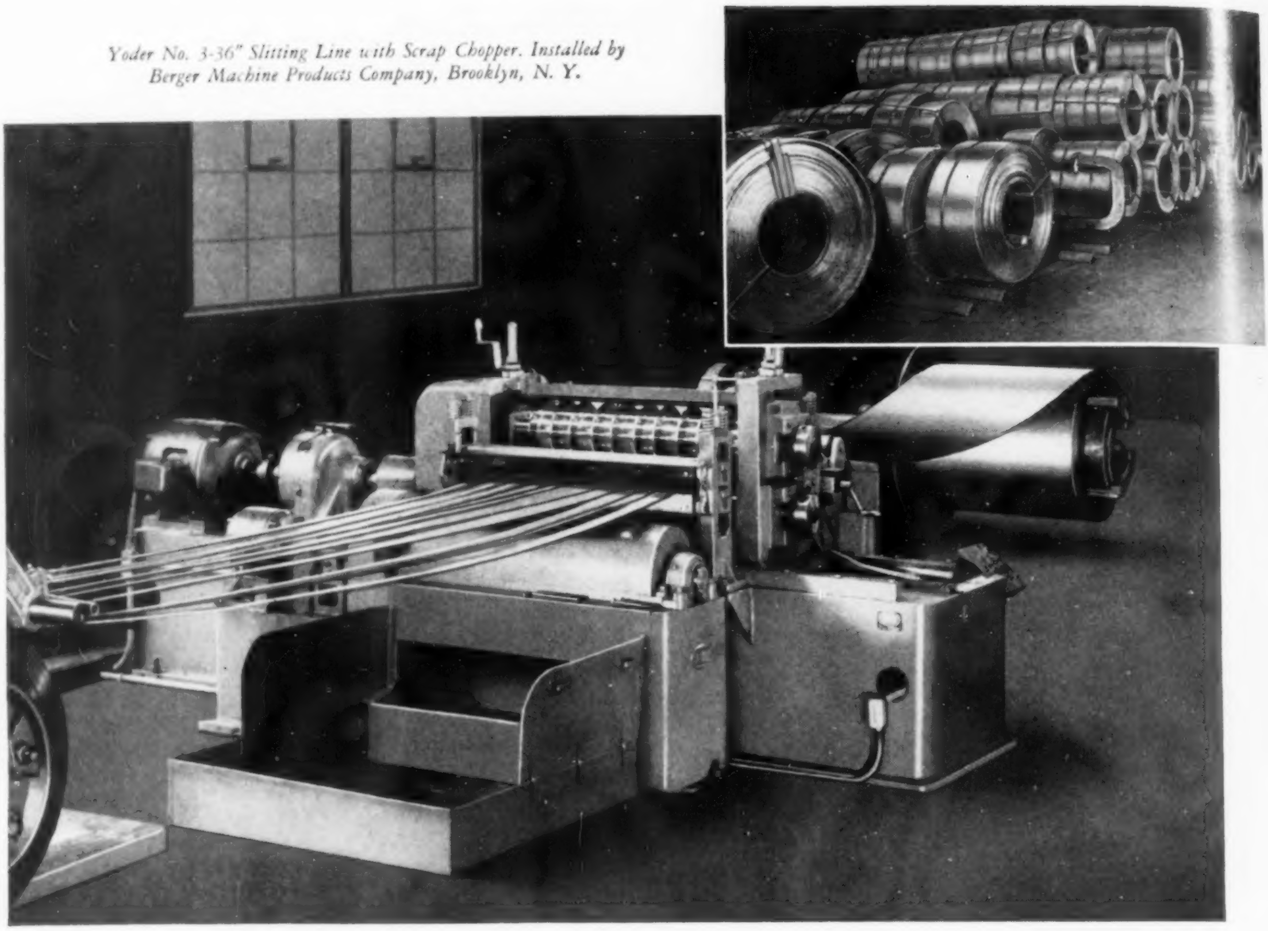
*Special units can be furnished and installed.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

6995

Yoder No. 3-36" Slitting Line with Scrap Chopper. Installed by Berger Machine Products Company, Brooklyn, N. Y.



OTTAWA 60

for DRAW DIES is *NEW*... *and* *NEWS*!

Write for a copy of the
OTTAWA 60 BLUE SHEET

This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.

ADDRESS DEPT. TE-65

In fact, this exclusive Allegheny Ludlum-developed die steel is mighty *good* news for any user of draw dies. Ottawa 60 is a high-carbon, high-vanadium analysis, initially designed for the primary purpose of drawing stainless steel.

In that service, Ottawa 60 does just exactly what it was developed to do: it performs without galling or pickup, and shows exceptional wear-resistance—as a long list of successful applications will prove to you. Two of them are illustrated above: a stainless hinge and a stainless sundae server.

But Ottawa 60 is a top performer on any draw die application! Also illustrated above are the two draws on a transformer housing of .037″ gauge SAE 1010 strip. After more than 25,000 pieces—*over 12 times any previous runs*—there was still no sign of pickup, or of wear on the Ottawa 60 punch or die.

This analysis can solve your draw-die problem jobs—or reduce your costs on almost any drawing operation. ● Call on our Mill Service Staff for any assistance. *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

For complete **MODERN** Tooling, call
Allegheny Ludlum

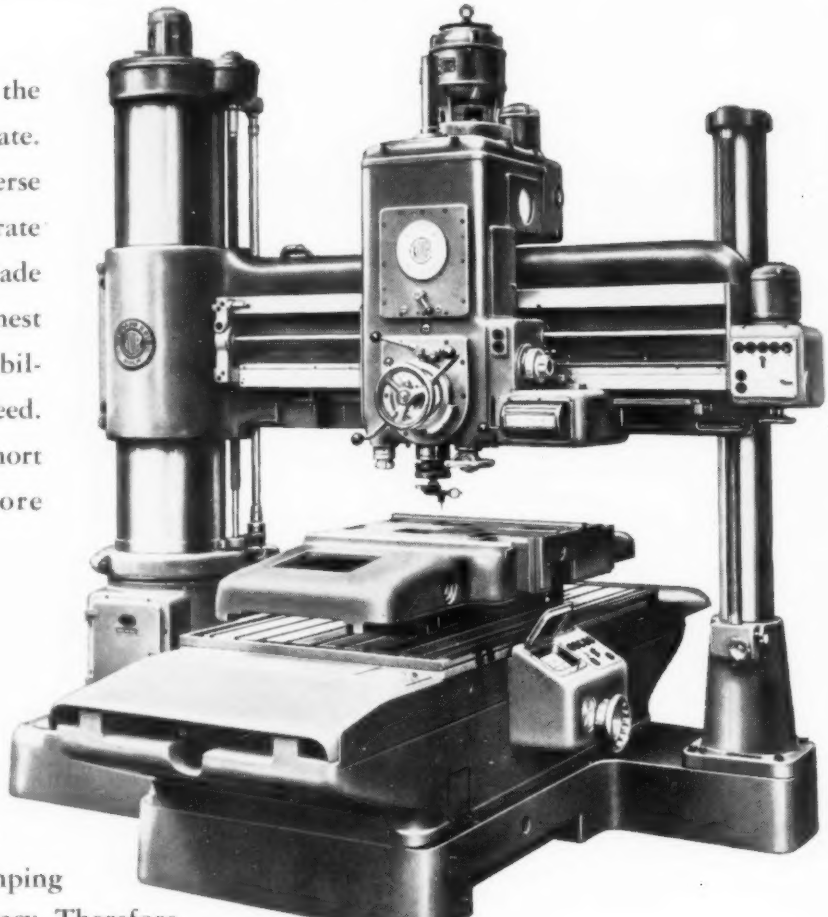
AL ®
FINE TOOL STEELS SINCE 1854

WAD 5581

WITH A KOLB OPTICAL JIG BORER

YOU CAN POSITION A WORKPIECE TO WITHIN .000125" IN A FEW SECONDS

Positioning a workpiece on the Kolb jig borer is fast and accurate. It's fast because of rapid traverse with adjustable stops—it's accurate because the optical system is made by Leitz, one of Germany's finest optical manufacturers. Repeatability of the coordinates is guaranteed. By eliminating costly jigs, short run jobs can be handled more profitably.



- Shock and distortion-free electro-hydraulic clamping does not impair accuracy. Therefore, reading accuracy equals positioning accuracy. Signal lights indicate if head and table are clamped or unclamped.
- Convenient pushbutton control—preselection of 18 feeds and 36 speeds.
- An excellent machine for drilling, boring, reaming, tapping and milling as well as precision measuring.
- Optical system has a magnification of 1:100—five inches on the focusing screen is equivalent to a movement of 0.05 inches along the coordinate.
- Working surface of table 69x39", clearance between columns 73", maximum distance between spindle and table 40".

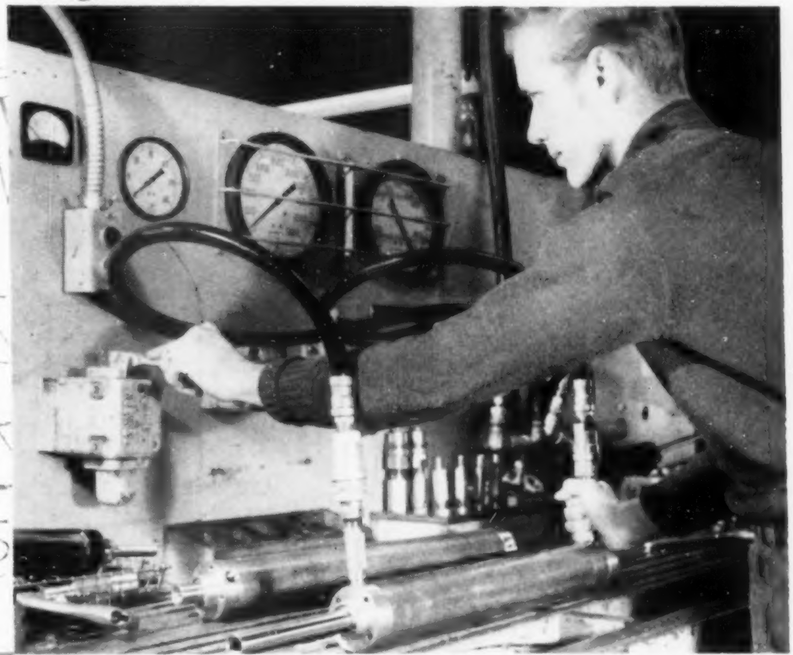
Write for more information.

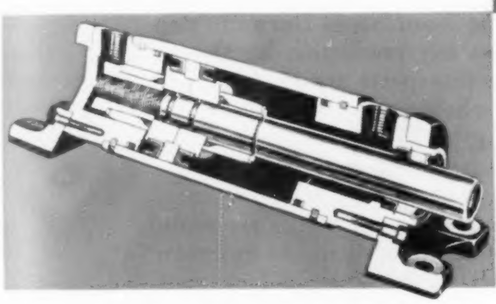
COSA *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

PRE-TESTED!

to assure dependable performance





and O-M CYLINDERS

fit where others won't

O-M CYLINDERS (air • hydraulic)

Complete testing facilities at our modern new assembly plant take the guesswork out of cylinder performance. Before shipment every O-M Air and Hydraulic Cylinder is "power-tested" and approved, assuring dependable prolonged service under all normal operating conditions.

Standard, semi-standard, "special" air and hydraulic cylinders available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. Completely interchangeable parts. Immediate delivery on many sizes.

mail coupon now!

for FREE catalog, complete set of ½-scale templates, showing all cylinders, mounts and mounting brackets.

ORTMAN-MILLER MACHINE COMPANY
13 143rd Street, Hammond, Indiana

☐ Have representative call ☐ Send latest catalog ☐ Send ½-scale templates

Name________ Position________
Company________
Address________
City________ Zone____ State____

The precise pitch of this wire helix, in its glass tube, is accurately measured by Hewlett-Packard Company, using a Kodak Contour Projector.

to make the difficult easy

...the easy economical

Using the same contour projector, Hewlett-Packard checks spacing and parallelism of this special tuning condenser.

Hewlett-Packard relies on the Kodak Contour Projector

Here is an on-the-job demonstration of how projection gaging can solve difficult problems in inspection, slash costs in checking parts to close tolerances.

Using a Kodak Contour Projector, Hewlett-Packard Company measures the pitch of a precision wire helix for a unique electronic tube. Surface and shadow illumination provide a 20× enlarged image of the minute and delicate part. "Without the Kodak Contour Projector," say Hewlett-Packard officials, "it would not be practical to make the measurements necessary to get a satisfactory instrument."

Using the same contour projector, Hewlett-Packard also checks spacing and parallelism of a special tuning condenser for electronic test equipment. Conventional shadow projection provides a 10× enlarged image of the leaves. "Use of the projector," the company reports, "permits economical measurements of parallelism to an accuracy impossible to obtain by other methods."

Diverse jobs like this are easily done with a Kodak Contour Projector. A twist of a dial provides whatever magnification is needed. A flick of a switch brings surface illumination to supplement shadow projection. Easy to see, isn't it, how a Kodak Contour Projector quickly pays for itself in use.

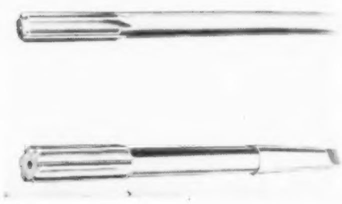
For more information on how you can use projection gaging in your own work, send for a free copy of "Kodak Contour Projectors."

EASTMAN KODAK COMPANY
Special Products Sales Division
Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

NEW, COST-SAVING SEMI-FINISHED CARBIDE REAMERS



Super Tool Company, Detroit manufacturer of precision carbide tools, has recently announced the availability of a complete line of cost-saving *Semi-finished Carbide Reamers*, made in a wide variety of sizes and types to accommodate almost any application.

REDUCED TOOL INVENTORY

Mr. Gordon Birgbauer, president, says, "The obvious advantage of *Semi-finished Carbide Reamers* is reduced tool inventory; you need keep only a limited stock on hand and grind to required diameter when needed. Of course, you also benefit by the lower initial cost of these reamers by doing your own finish-grinding."

.020" GRINDING STOCK

All Super semi-finished reamers are furnished with .020" grinding stock, enabling your tool room to turn out any size within each range in a hurry to meet emergency needs. They are furnished in regular and flute-long types, with either straight or tapered shanks. All sizes are stocked by leading tool and industrial supply houses everywhere.

FREE DESCRIPTIVE LITERATURE

Super Tool Company manufactures a large line of carbide tools including milling cutters, end mills, drills, ejector tools and single point tools in both standard and special types. Catalog No. 55 describes the complete line and is available free on request to the manufacturer. *Super Tool Company, Dept. 328, 21650 Hoover Rd., Detroit 13, Michigan.*

Here's GREATER POWER for you ... in a MORE COMPACT DESIGN

FEATURES YOU WILL LIKE:

- Greater power from a more compact design.
- Resistance to corrosion throughout.
- Positive sealing with minimum friction loss.
- Materials selected for strength, durability and long cylinder life.
- Interchangeable heads and mountings.
- Conformation to J.I.C. Standards.
- Automatic compensation for rod packing wear.
- Built-in piston rod scraper to prevent dirt and abrasives from scoring rod or damaging packings.
- Adjustable cushions of unique design.
- Wide choice of operating pressures; Air to 250 psi; hydraulic to 750 psi.

The New HANNA T 750 Series *Fluid Power* CYLINDERS

● You'll find some unique and very interesting operating features in these new Hanna **T750** Series Fluid Power Cylinders . . . features that will help you solve many of your cylinder application problems more easily and more simply. The new Hanna **T750** Series comes in a range of capacities, sizes and mounting styles—for air operation up to 250 psi and hydraulic operation up to 750 psi.

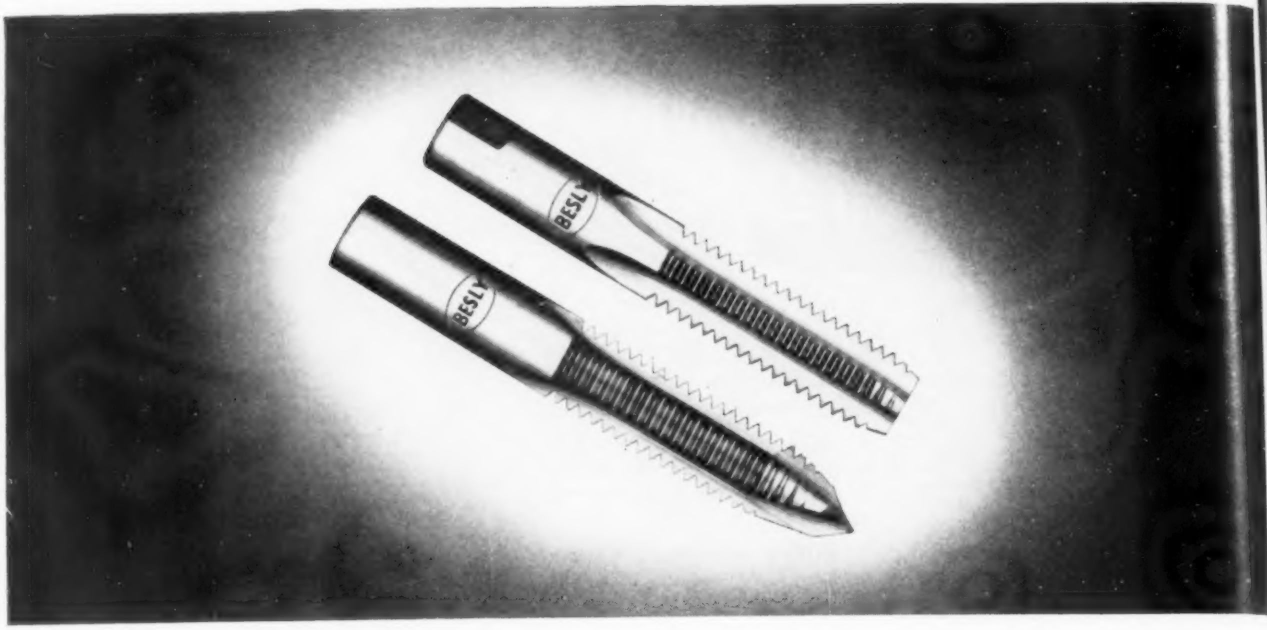
For details, ask your Hanna Representative (see your classified telephone directory), or write today for a copy of the new **T750** Fluid Power Cylinder Catalog. No obligation.

NEW CATALOG

Write for Catalog 750A—it gives complete details.

Hanna Engineering Works

1768 Elston Avenue, Chicago 22, Illinois



New Besly Stub Tap for Screw Machines

SAVES SET-UP TIME • FITS STANDARD BUSHINGS • HAS STRONGER SHANK

Available at No Extra Cost from BESLY

A new, shorter length tap that need not be altered before use in screw machines has just been made available as a standard item by Besly-Welles Corporation. Developed in cooperation with the National Screw Machine Products Association, the new tap conforms to standards recently drawn up by that group.

SHORTER SHANK, SHORTER THREADED PORTION

The shank (and threaded portions in larger sizes) of the new Stub Tap have been shortened to enable it to fit into the space between the spindle nose and tool holder of screw machines. In the past, it has been necessary for users to cut off part of the shank and even part of the threaded portion of standard hand taps to fit them into screw machines . . . or order higher priced "specials." Now, screw machine operators can save set-up time by using the new Stub Tap just as it comes in the package.

SIMPLIFIES BUSHING INVENTORY

The shank of a Stub Tap is the same size as its nominal O.D. This permits standard sized bushings to be used and reduces bushing inventory problems. The full diameter shank provides greater strength than standard hand taps which have shanks usually turned down in the larger sizes.

FACTORY-PERFECT ACCURACY

The shank of the Stub Tap is made concentric with the threaded portion, assuring accurate alignment in the tool holder. Since it is not necessary to cut off the forward threaded portion of a Stub Tap, chamfer and back taper are maintained factory-perfect. Squares, except for two small driver flats at the end of the Stub Tap, are eliminated. This permits better holding power, better alignment and longer accuracy.

FAST DELIVERY FROM STOCK

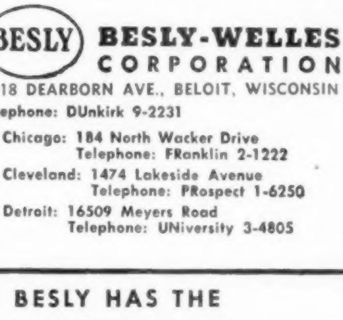
Complete stocks of the new Stub Tap will be on hand at Besly distributors by June 1. Users will be able to get the same fast delivery on Stub Taps as they have on other Besly standard taps.

AVAILABLE IN SIZES THROUGH 1-IN.

The new Stub Tap is made in fractional sizes from 1/4-in. through 1-in. and in machine screw sizes from #0 through #14. A bulletin describing the new Stub Tap and giving the standards applicable to it is available at no cost or obligation. See your Besly distributor or write or call:

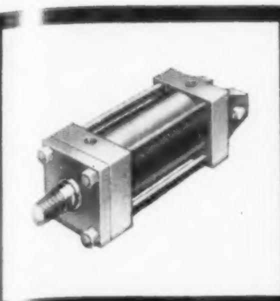
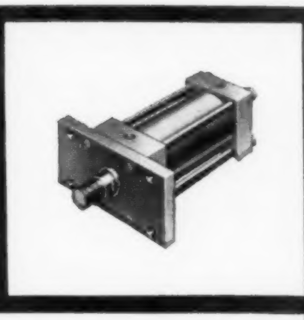
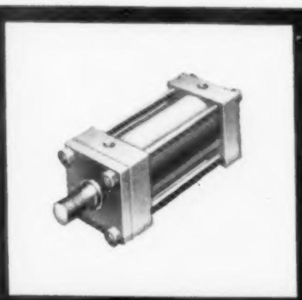
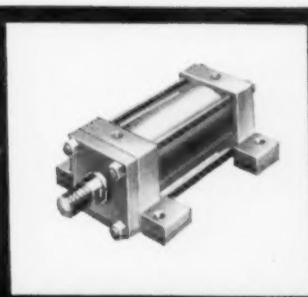
BESLY **BESLY-WELLES CORPORATION**
118 DEARBORN AVE., BELOIT, WISCONSIN
Telephone: DUnkirk 9-2231
In Chicago: 184 North Wacker Drive
Telephone: FRanklin 2-1222
In Cleveland: 1474 Lakeside Avenue
Telephone: PRospect 1-6250
In Detroit: 16509 Meyers Road
Telephone: UNiversity 3-4805

BESLY HAS THE COMPLETE LINE



Order *all* of your cutting tool needs for your screw machines from your Besly distributor—your quality source for a complete line that means long life, accurate cutting and lower tool costs.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-268

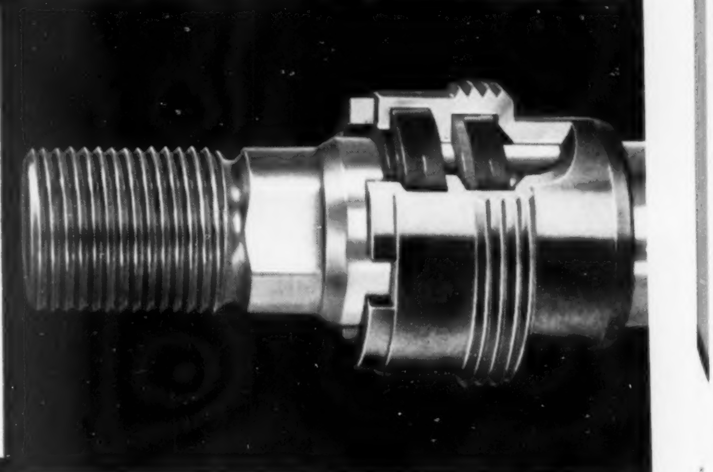





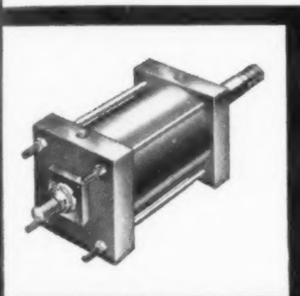
Series "H" Hydraulic Cylinders

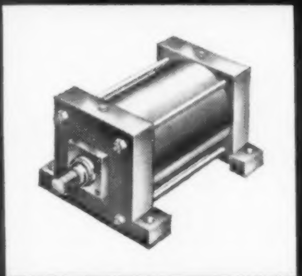
9 bore sizes from 1½" to 8"...13 standard mountings, many combinations. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished, then hard chrome plated for minimum friction and long packing life.

Series "A" Air Cylinders

11 bore sizes from 1½" to 14"...13 standard mountings, many combinations. Steel heads. Cylinders of hard-drawn, high-strength brass, honed to a satin finish. Piston rods ground and polished, then hard chrome plated for extreme smoothness as well as corrosion resistance.








Only HANNIFIN Square-Type Cylinders Have This Revolutionary New Gland

The gland you see here represents the biggest improvement in cylinder design in the last 50 years. And, you'll find this gland only in Hannifin Square-Type Air and Hydraulic Cylinders.

This exclusive Hannifin Gland is a bronze cartridge, *externally removable and replaceable as a unit* to meet J.I.C. recommendations. The packing is new, too. Outside is the "Wiperseal." It serves a dual purpose as it *wipes both ways* to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. Inside is the "Lipseal"...self-compensating, self-relieving and nonadjustable. It provides an efficient seal throughout its long life.

Find out how easily you can apply Hannifin Cylinders to your requirements. They're available for prompt delivery—in all sizes and all standard mounting styles—and at competitive prices despite all their exclusive features.

WRITE FOR BULLETINS

Bulletin 113. Series "H" Hydraulic Cylinders

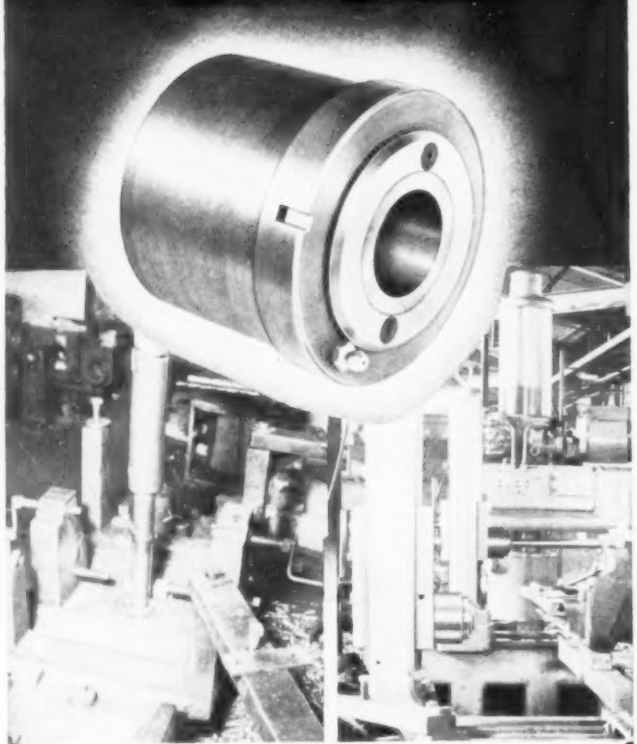
Bulletin 213. Series "A" Air Cylinders

HANNIFIN

Hannifin Corporation, 519 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

JERGENS LIVE BUSHINGS

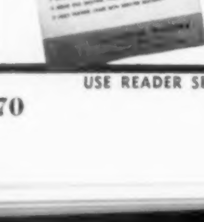


Jergens Bushing piloting application on radial drill press

Horizontal Boring Mill application

Eliminate Bushing Maintenance In Precision Mass Production

Jergens Live Bushings solve the problem of constant bushing wear, tool breakage, bar wear, scoring and chatter. They reduce loss of precision and production to a minimum. Rotating with the tool or pilot bar and incorporating an absolute seal against coolants and dirt entering the bearing cavity, Jergens Live Bushings make obsolete drill and jig bushings in precision mass production. Two sets of tapered roller bearings that adjust with wear to maintain concentricity give each Jergens Bushing radial load support. Jergens Live Bushings pay their cost many times over by reducing machining delays, tool costs and by permitting the use of carbide tools to full capacity on both new and old equipment.



Write for complete catalog

JERGENS DIVISION
DONLEY PRODUCTS, INC.
Dept. TE-5
11106 Avon Ave., Cleveland 5, Ohio

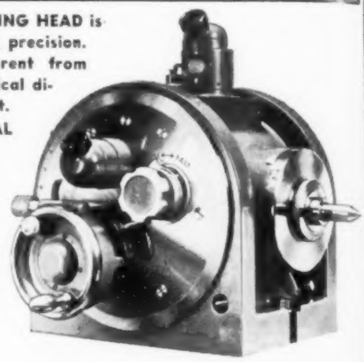
USE READER SERVICE CARD; INDICATE A-5-270-1

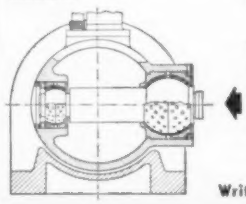
The New LEITZ Optical Dividing Head

A CUSTOMER SPEAKS:

"Without our Optical Dividing Head, we would not eve attempt to make the critical indexing work nowaday necessary for things that fly, or mechanism that mus control angular motions to hit targets at a distance, t measure degrees, minutes and seconds, to eliminate angular velocity errors and vibrations in quick running mechanisms, etc."

The LEITZ OPTICAL DIVIDING HEAD is the last word in indexing precision. Its construction is different from other optical and mechanical dividing heads on the market. A NEW DOUBLE SPHERICAL BALL BEARING, DOUBLE READING IN THE SAME EYEPIECE 180° APART, motor drive attachment and other features make the LEITZ an important aid required in any shop where precision is demanded.





The 2 spherical ends of the spindle are carried in hardened steel cups with several hundred small precision balls held in place by ball cages in such a way that each ball creates its own path. There is no play, either radially or axially, no oil film, no wear and a very large load capacity.

Write for Descriptive Bulletin --- Code GIPAD

Geo. SCHERR OPTICAL TOOLS, Inc.

200-TE LAFAYETTE STREET • NEW YORK 12, N.Y.

USE READER SERVICE CARD; INDICATE A-5-270-2

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 167.

DYKEM STEEL BLUE®

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench: metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

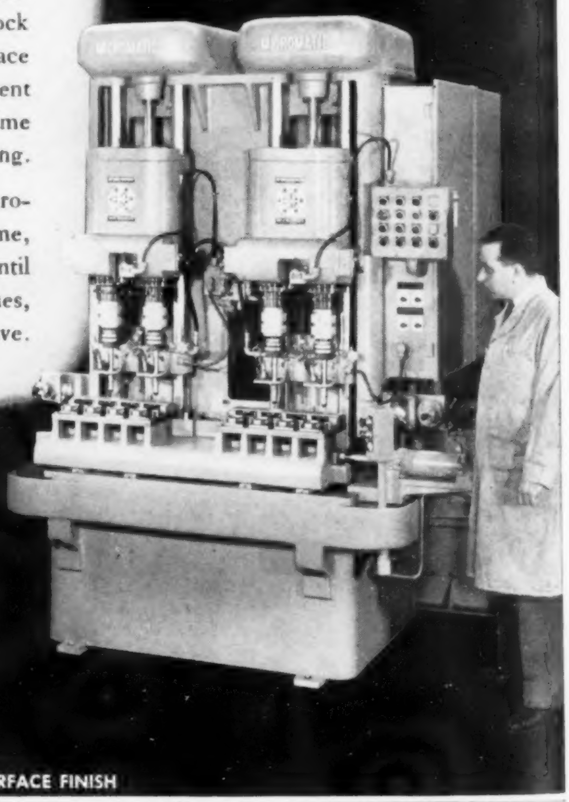
USE READER SERVICE CARD; INDICATE A-5-270-3

The man who needs a new machine tool and doesn't buy it is paying for it anyway... **in lost production**

Because costs are set largely in labor and burden, lost production is reflected directly in high unit cost. Old equipment is not the only cause. Failure to utilize the latest processing techniques may be keeping you from increasing production and lowering unit cost.

For example, consider the low-velocity, controlled-abrading Microhoning process which combines stock removal, geometric accuracy, size control and surface finish to increase *production* and *precision*. Inherent characteristics of Microhoning eliminate such downtime factors as tool sharpening, fixture and machine aligning.

The difference between your current output and the production possible with Microhoning will, in a short time, cover the cost of new Microhoning equipment. And until you do utilize the most efficient processing techniques, you are paying for new machine tools you don't have.



PART:
Connecting rod—wristpin and crankpin bores.

PROBLEM:
High unit cost; how to increase production without increasing labor or burden cost.

SOLUTION:
Microhoning—simplified processing of wristpin bore (eliminating 3 operations); gross production increased to 600 bores per hour, within all specified tolerances.

*MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

MICROMATIC HONE CORPORATION

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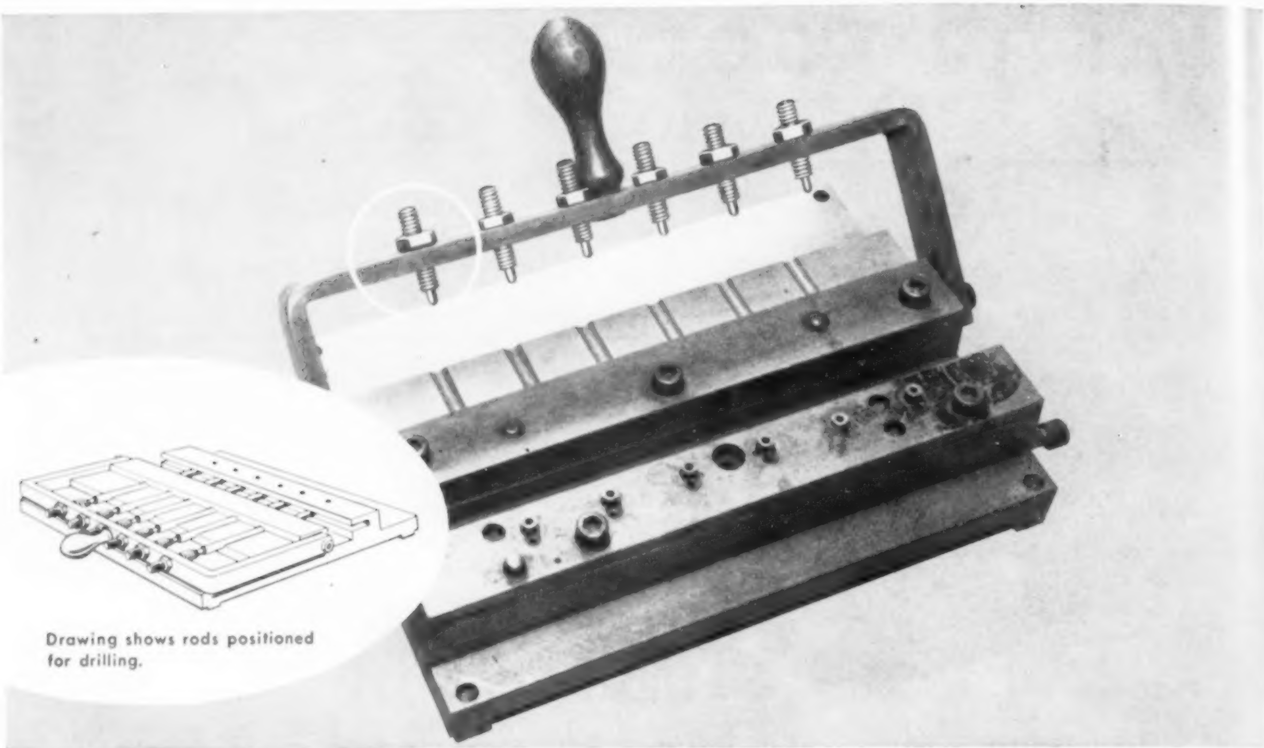
REPRESENTATIVES: Allied Northwest Machine Tool Corp., 103 S.W. Front Ave., Portland 4, Oregon • Mason Machine Tool Company, 415 So. Second East, Salt Lake City, Utah • Perine Machinery & Supply Co., 1921 First Ave. South, Seattle 4, Washington
REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

MICRO-PRECISION DIVISION • 2205 Lee Street, Evanston, Illinois
Hydraulic controls • Diesel fuel injection equipment

Visit Booth 1211 at the Show.
See demonstrated how
Microhoning increases production.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE



Drawing shows rods positioned for drilling.

How to spread the profits on a sandwich jig

Ready-made Vlier Spring Plungers eliminate costly "home-made" devices; provide accurate, pre-set end pressures

The sandwich-type drill jig shown above demonstrates a typical application for Vlier Spring Plungers. Six Standard-nose models are used to locate cylindrical parts until the top of the jig can be positioned securely for the drilling operation.

There are probably a dozen similar applications in *your* tool room where these handy, precision tools can save money. They're now widely used in all industries for positioning parts in jigs and fixtures, breaking oil seals and ejecting parts from punch press dies, as detents, in end product applications—*wherever constant, accurate spring loads are needed.*

MACHINED TO CLOSE TOLERANCES

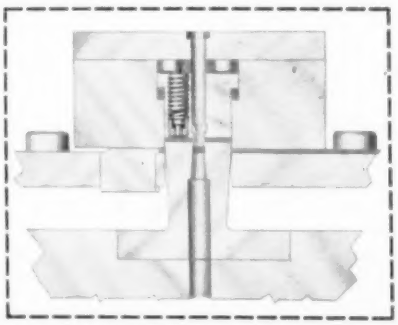
Vlier Spring Plungers are simple tools, carefully designed and manufactured to give years of service. Large bearing surfaces between the plunger nose and the body assure perfect alignment of the plunger nose at any extension. Close tolerances prevent binding and wobble, assuring smooth travel of the plunger nose over its full length. The tool is so designed that the plunger nose telescopes completely, permitting the tool to be used where mating surfaces must be flush.

SOFT CORE MINIMIZES FRACTURING

Case hardening the plunger nose gives it extremely good resistance to wear. However, the core remains ductile, overcoming brittleness and the hazards of fracturing under impact which is common with hardened, high-carbon steels.

EASILY INSTALLED OR REMOVED

Installation of Vlier Standard-nose Plungers is quickly accomplished with a simple spanner-type wrench. Adjustment of the Hexnose type is even simpler, since a standard end or box wrench can be used.



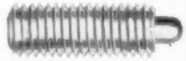
Thousands of Vlier Silvernose Spring Plungers are used in punch press dies to break oil seals and eject parts. Special springs, developed for fast, repetitive operations, give millions of flexes without crystallizing.

Providing your tool engineers with a selection of these ready-to-use tools will speed jig, fixture and die manufacture, and insure uniform, accurate loading, resulting in fewer rejected parts.

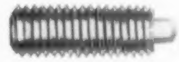
Your Vlier distributor carries a complete line *in stock.* Why not call him now?

Four Nose Types Available

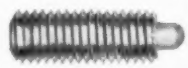
Wide variety of diameters and lengths.



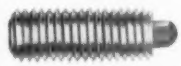
STANDARD NOSE
Primarily for jig and fixture use.



SILVERNOSE
Light end pressures for punch press operations.



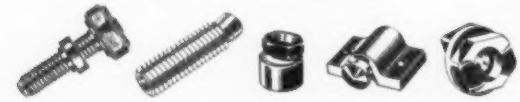
PLASTIC NOSE
For use with aluminum and brass.



HEXNOSE
Extremely easy to adjust.

Write for your free copy of the new 1955 Vlier Catalog

Other Vlier Tooling Specialties

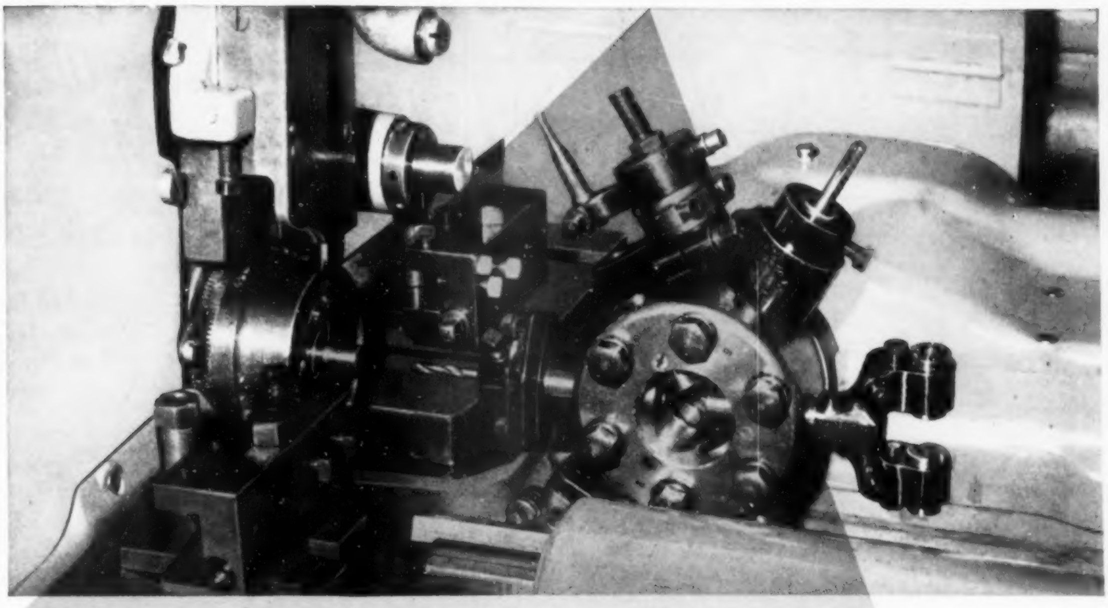


TORQUE THUMB SCREWS | SCREW BALL CLAMPS | TOGGLE PADS | SPRING STOPS | FIXTURE KEYS

VLIER ENGINEERING INCORPORATED

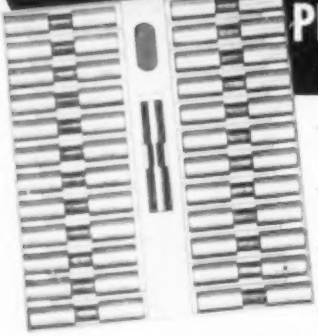
8900 Santa Monica Blvd., Los Angeles 46, California

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-274

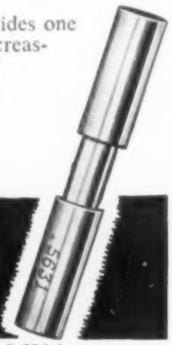


R AND L

CLOSER TOLERANCES with DELTRONIC TENTH PLUG GAUGES



- ★ Size variation by ten thousandths
- ★ Set of 25 costs approximately same as Go and No-Go gauge.
- ★ Available in increments of 1/64" from 1/8" to 1"
- ★ Hardness is Rockwell C62/C64



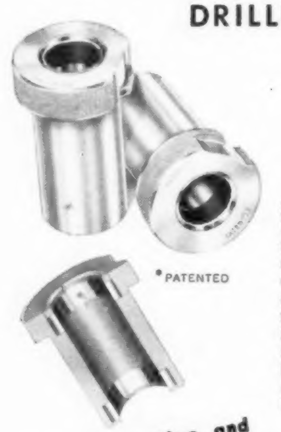
This new system of precision gauging provides one gauge of nominal size plus 12 gauges of increasingly larger sizes in .0001" increments and 12 gauges of decreasingly smaller sizes in increments of .0001". Each gauge is identified. It is the same size on both ends to double the life in usage.

For further information write Dept. D12.

DELTRONIC CORPORATION
1507 RIVERSIDE DRIVE • LOS ANGELES 31, CALIF.

USE READER SERVICE CARD; INDICATE A-5-276-1

INCREASE PRODUCTION... SAVE TIME & MONEY ON YOUR DRILLING OPERATIONS



*PATENTED

MEYCO

Carbide Inserted Bushings last longer, cost less in the long run

Here is a bushing that combines the best features of steel and carbide: the strength of steel and the long life of carbide. First cost: slightly higher than ordinary steel bushings; their life: many, many times as great. In addition to such obvious savings, MEYCO bushings increase the life of drills and reamers, produce accurate work for a longer period of time, save on machine-down time and on nonproductive man-hours.

☆

Auto manufacturer says: "... the steel bushings previously used averaged about 28 hours life. MEYCO bushings ran 1,168 hours before they were unusable."

For information and prices write for Meyco Bushing Catalog No. 42

W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-5-276-3

for press room flexibility...

LITTELL

mobile, self-powered feeding and straightening machine

Used with any hand-fed press or square shear, this machine instantly provides *automatic* straightening and feeding. These Littell machines operate independently of using equipment, supply their own smooth, hydraulic power. There is only a simple electrical connection between units, permitting easy reconversion to hand feeding. The machines feed up to 19" lengths at 40 strokes per minute and handle any coil stock up to .125" thick and 24½" wide. Pacemaker control automatically synchronizes feed and press action. *Write for Catalog 6-U, giving full details.*

F. J. LITTELL MACHINE CO.
Speed with Safety

ROLL FEEDS • COIL CRADLES
STRAIGHTENING MACHINES
REELS • AIR BLAST VALVES
District Offices: Detroit, Cleveland

4199 N. RAVENSWOOD AVE., CHICAGO 13, ILL.

USE READER SERVICE CARD; INDICATE A-5-276-2

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 167.

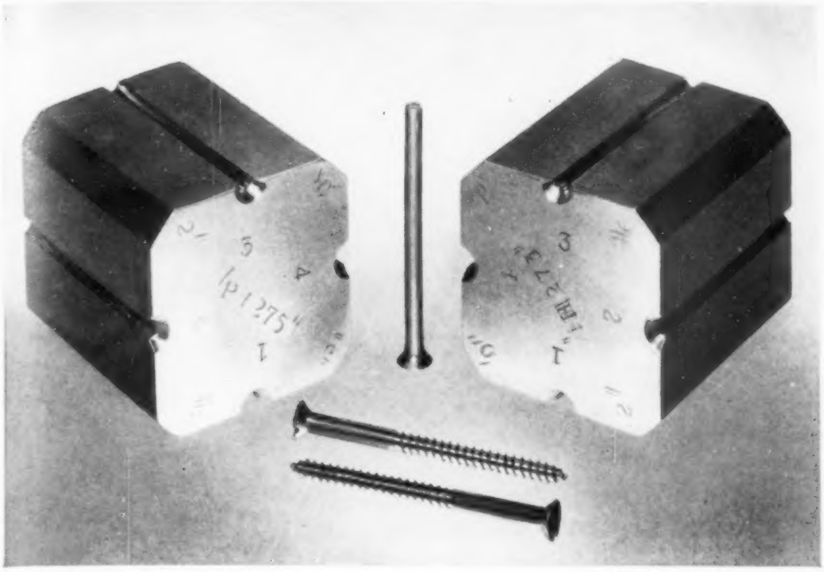
Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



150,000 Screw Blanks per Dressing with This Cold-Heading Die Steel

Shown here are representative header and gripper dies used in the manufacture of wood screws by Southern Screw Company, Statesville, N. C. Made of Bethlehem Cold-Heading Quality Carbon Tool Steel, the dies are hardened to Rockwell C 59/61. They are working tools of a cold-header, and form steel, brass or aluminum stock into screw blanks, turning out up to 150,000 blanks before redressing is required.

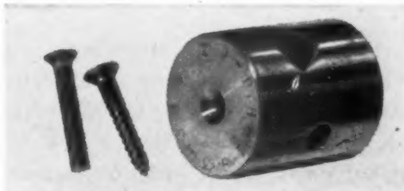
Southern Screw Company reports that they like this grade of Bethlehem Tool Steel because of its ease of machinability, uniformity of heat-treatment, minimum distortion in heat-treatment, good wear-resistance, and good shock-resistance.

Bethlehem Cold-Heading Quality Carbon Tool Steel is a superior grade of tool steel, intended for specialized types of tools where cleanliness and hardenability are important.

TYPICAL ANALYSIS

Carbon, 0.90 to 1.00
Phosphorous, 0.020 max
Sulphur, 0.020 max

Bethlehem Cold-Heading Carbon Tool Steel has high shock-resistance because it is accurately controlled for hardenability. Its controlled carbon range results in good wear-resistance, and provides the



toughness to withstand cold battering.

Ask your tool steel distributor to send you a trial order of Bethlehem Cold-Heading Carbon Tool Steel. You're sure to be pleased with the way it performs.

• • • • • • • • •

DIE OF 67 CHISEL GIVES GOOD SERVICE IN MAKING PART FOR REFRIGERATOR

This blanking, drawing and forming die, made of Bethlehem 67 Chisel Tool Steel and hardened to Rockwell C 52, is used in producing refrigerator unit end caps for a manufacturer of appliances. The caps are made from steel, 3/8 in. thick, approximately 90,000 pieces being turned out before redressing is required. 67 Chisel, our general-purpose, tungsten-type of shock-resisting tool steel, is well known for its wear-resistance, and also for its low distortion in heat-treatment.

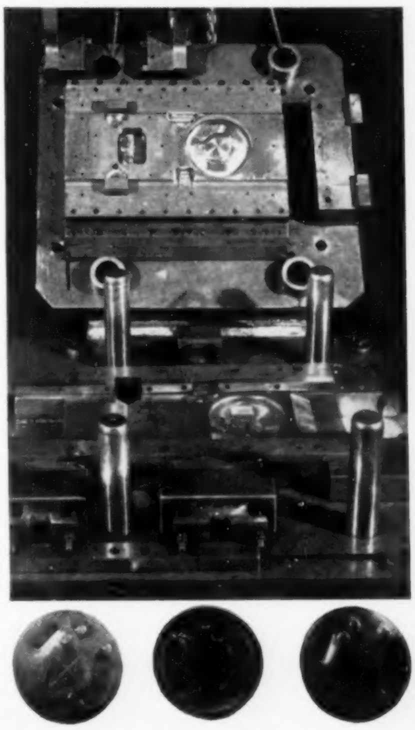
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Bake Tools After Plating

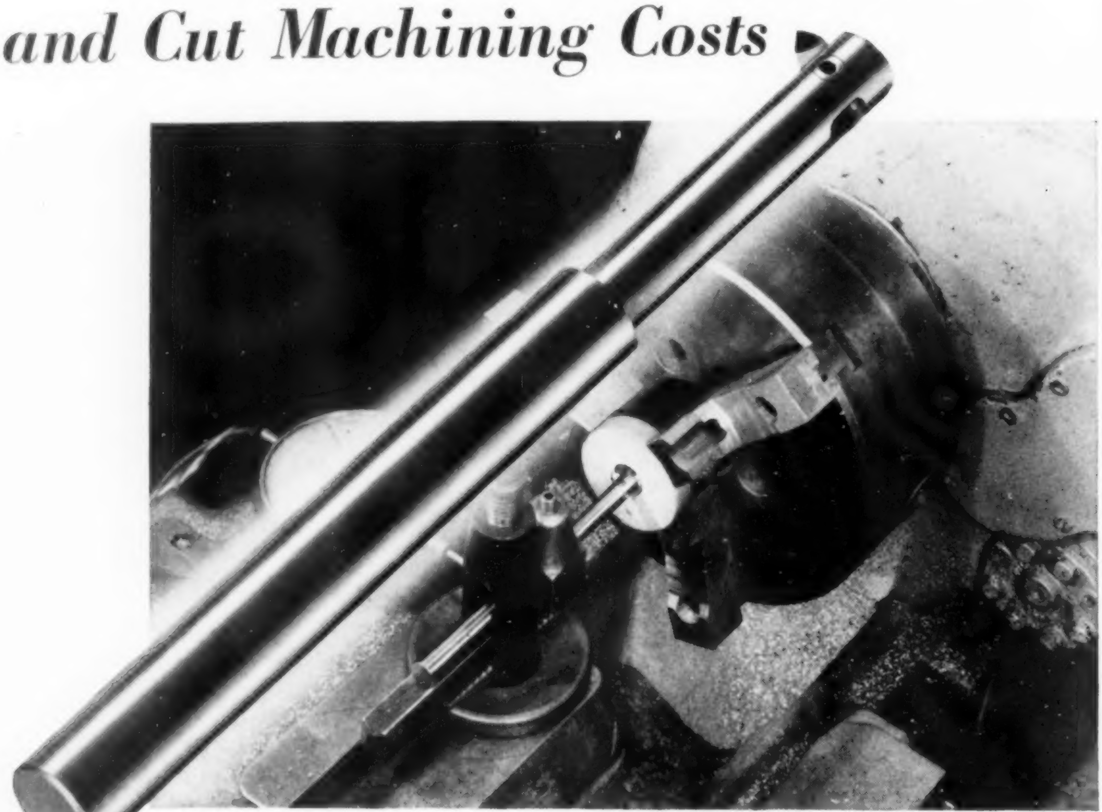
Electroplating with chromium or nickel is often used to salvage tools by regaining worn dimensions, or to correct mechanical errors. It is also used for decorative purposes, and is sometimes advantageous for resisting wear or metal pickup.

Plating of hardened tools is relatively simple. Yet it can be a hazardous operation if it is not followed by tempering or baking. During deposition of the plated metal, a considerable amount of hydrogen is deposited on the tool, and some of it diffuses into the tool, causing extreme brittleness. If the tool is used immediately after plating, breakage in service may occur. To avoid this possibility, temper the tool at from 300 to 400 F for at least four hours, so as to restore its original ductility. This should be done as soon as possible after plating.

Grinding should never be attempted on the steel itself prior to tempering. If tempering is omitted, the tool will gradually recover its ductility at room temperature in from two to three weeks, but will be subject to breakage if used earlier.



The New Way to Reduce Chatter and Cut Machining Costs ▸



...MALLORY No-Chat* Boring Bars

Vibration of cutting tools can be nearly eliminated and overall machining costs substantially reduced when you use Mallory No-Chat boring bars. Made from a unique alloy developed by Mallory metallurgical research, they are more than twice as dense as steel, and have far greater rigidity, tensile strength and thermal conductivity.

No-Chat bars permit you to make deep inside cuts with long tool overhang. You can often turn small diameters that used to require finish grinding.

Longer production runs. Tips last far longer between grinds, because they run cooler and hold their edge longer.

Heavy cuts per pass are possible because vibration is damped out at the source . . . another saving in production time.

No-Chat bars are re-usable. Just replace the tip. Non-annealing *No-Chat* metal eliminates grain growth troubles.

A wide selection of square and round stock is available, in sizes useful for boring bars, tool shanks and for planer or shaper tools. Write to Mallory today for our bulletin that gives complete technical data on this unique way to do better machining at lower cost.

*Trade Mark
Patent Applied For

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Serving Industry with These Products:

Electromechanical—Resistors • Switches • Television Tuners • Vibrators
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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio


1967

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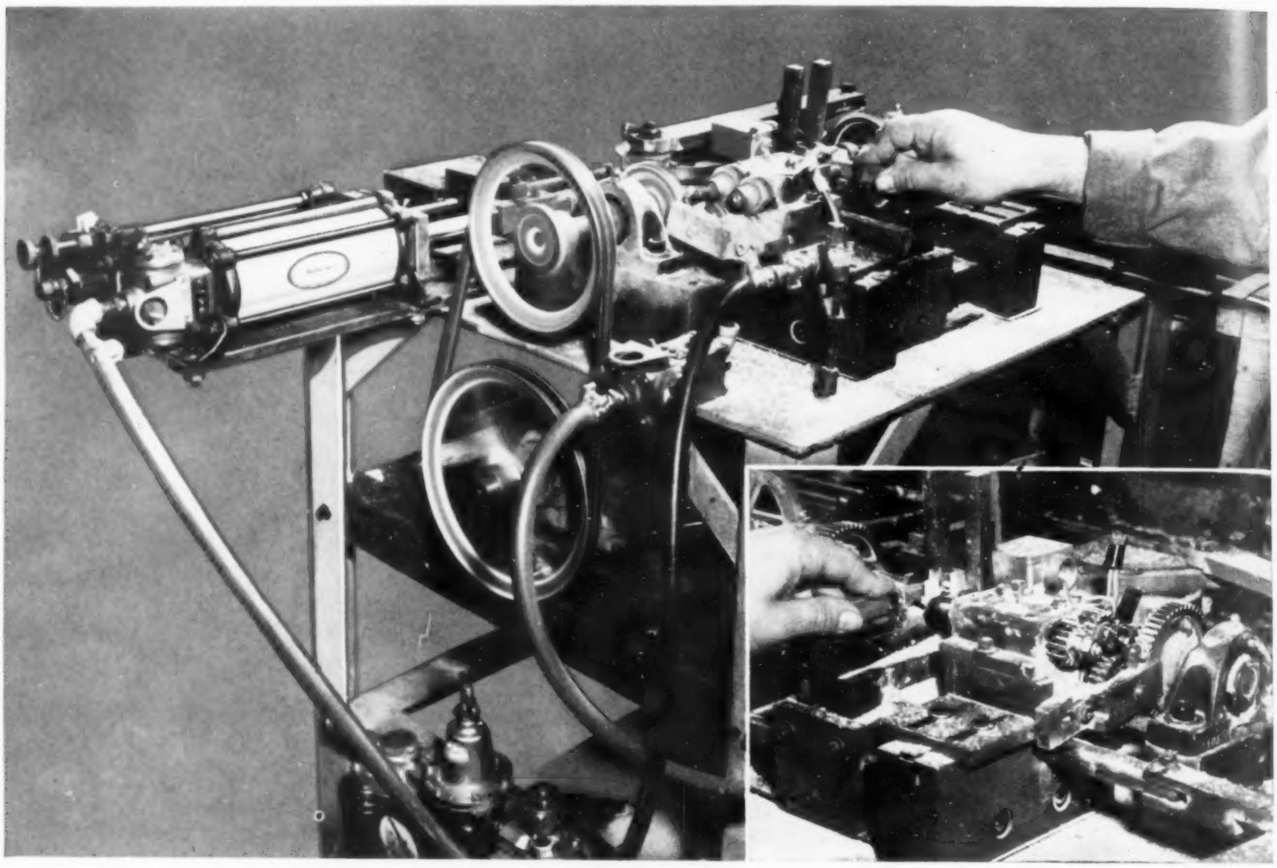
The Case of The Bellows Co.

VERSUS

Worker Fatigue

Excerpts from tape recorded interviews in the plant of [redacted], Holyoke, Mass., dealing with the conversion of existing equipment to automatic operation and the construction of special tool-room built machines through the use of Bellows "Controlled-Air-Power" Devices.



1205-A

Interview with [redacted], Vice President

Q. From the standpoint of management, what particular thing would stand out as far as Bellows air equipment is concerned?

A. Today all of us have to be very conscious of our labor relations. By eliminating fatigue, we have more satisfied employees which, of course, is a very important factor. From the standpoint of increased production, that is obviously a very important consideration of management.

Q. In other words, Bellows Air Motors work both ways?

A. That's right. They're helpful to both sides of the picture.

Interview with [redacted] Operator of a Bellows equipped drilling and counterboring machine

Q. How long have you worked here, [redacted]?

A. Going on 8 years since the factory first opened up.

Q. How do you like working on this automatic machine?

A. Well, it's swell.

Q. Is it easier than doing the work by hand?

A. Absolutely.

Q. When you were doing this operation by hand, did it make your arms very tired?

A. Yes, because you had to keep turning the wheel that they use for the operation left and right and you can't get an even feed; in other words, a steady speed—while on the automatic, you just hand it in and it works by itself.

Q. How do your arms feel at the end of the day?

A. There is a lot of difference from the automatic and the hand machine.

Q. After working on this machine, [redacted] do you feel any like going out in the evenings and enjoying yourself?

A. Yes, I go out three and four times a week — Polish dancing.

Q. Polish dancing?

A. Right. Nothing but.

Q. Do you use your arms much there?

A. It all depends on how you operate.

Interview with [redacted], Production Manager

Q. What is your rate of production on this machine, [redacted]?

A. We're running now about 3,000 to 3,500 per 7 hour day.

Q. *[there any way we could give a comparative production [in]crease on this method over hand operated method,* [redacted]*?*

A. [W]e had already figured that out and it came to 400%, [o]n this particular machine. On our saws, it will run [ab]out 700%.

Q. *[H]ow would this machine compare with an electrical [d]riven gear machine?*

A. [W]e have electrical driven gear machines, but we are [go]ing to Bellows. That should be self explanatory—we [w]ouldn't be going to the trouble of going to Bellows [eq]uipment if the others were satisfactory.

Q. *[W]hat about the safety factor on this machine?*

A. The safety factor is much greater than on the gear driven machines, due to the fact that the machine can be stopped. As you will notice, it stops after each cycle, which we cannot do on the gear driven or mechanical machine.

Q. *It would be rather dangerous inserting and removing the piece if the machine was continuous cycling, is that right,* [redacted]*?*

A. Yes, we've had a few accidents already—one girl ran a drill right through her finger—through bone and all, and that is probably one of the things that got us into Bellows on this particular machine.

Q. *Approximately how many applications using Bellows air equipment do you have in your shop here,* [redacted]*?*

A. Without taking time to count, since we started very recently, I would say we have at least 15 or 20.

Q. *What percentage of your equipment would that be? 20%-50%?*

A. That would be about 10% only. You see, we have just started to convert to automatic air operation recently, due to the fact that competition started to grow. We find ourselves in the same spot others do, we have to meet competition—we can't rest on what we are doing. So, we have started to convert and we just can't get converted fast enough. Our engineering department can't quite keep up with us.

Q. *How long has this machine been in operation—that we are photographing now?*

A. That one has only been in operation about 2 months, and, incidentally, of all the Bellows equipment we have, none of it has been serviced yet.

Q. *Not at all?*

A. Not at all. We have never had any occasion outside of a minor adjustment, to service any of our machines—with Bellows equipment, that is.

Q. *When converting to automation, do you find that Bellows air equipment gives you the best answer?*

A. Bellows equipment gives us the only answer as far as feeding a machine is concerned.

Q. *How about the adaptability,* [redacted]*? Installing it on these different machines? Do you find that simple?*

A. When we first tackled Bellows, we were a little bit afraid of it, I believe, that's perhaps what has held it back so long, but now that we are doing it, we are sort of ashamed of ourselves because it is comparatively simple. Very simple, as a matter of fact, easier than making mechanical devices.

Q. *From talking to you I gather that the equipment does pay for itself in a rather short time, is that right?*

A. The Bellows equipment that we have in the plant right now, and it hasn't been here too long, has paid for itself already.

Q. *You mentioned you used many physically handicapped persons here.*

A. Oh, yes, we hire the physically handicapped if we can. It is hard for that type of people to get a job. They are eager and willing and very happy with their work here.

Q. *And the physically handicapped have no trouble performing these jobs?*

A. None, whatsoever. They can sit down and do the work, or stand up and do the work, as they see fit. A person with one hand can do the job as well as a person with two hands. A person with a short leg has no difficulty whatsoever.

Q. *Is that program a result of your using Bellows equipment?*

A. No, we have always tried to help the physically handicapped anyway, but as a result of using Bellows equipment, we find we can do it more readily now, because we have certain applications where before we could not use physically handicapped persons.

Interview with [redacted], Vice President

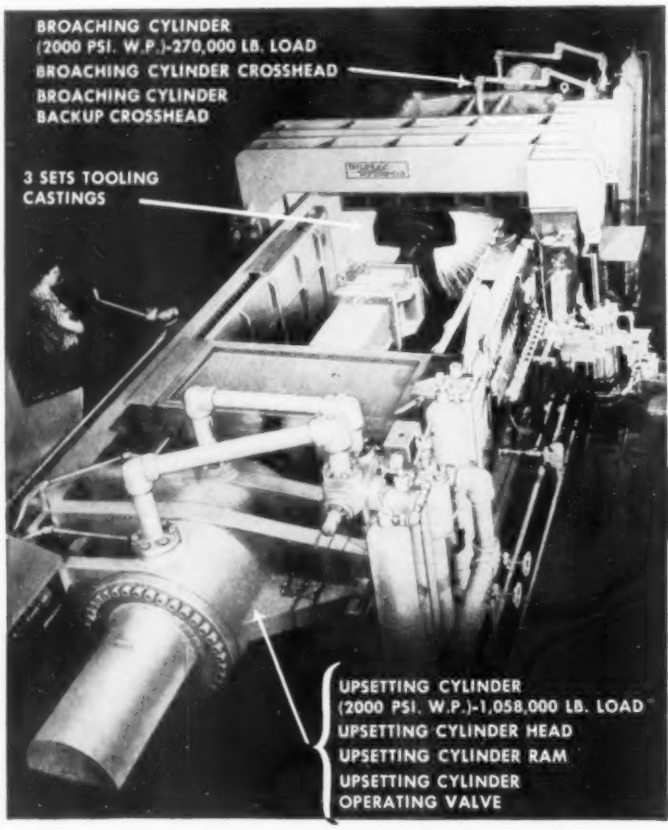
Q. *Mr.* [redacted] *what was it decided you upon using Bellows equipment?*

A. Fortunately, it was the persistence of your very good Field Engineer* who sold us on the idea by his own initiative in coming in and telling us how the equipment could be adapted for our operations.

* *There are more than one hundred Bellows Field Engineers—one or more in every major industrial area in the United States and Canada. They are listed in their local phone directories under the name "The Bellows Co." (In Canada, under "Bellows Pneumatic Devices of Canada, Ltd.") These men know production. They are experts in adapting "Controlled-Air-Power" to existing machines, and they can work skillfully and helpfully with your engineers in designing inexpensive special purpose machines for your specific needs. They are at your service without cost or obligation.*

The MEEHANITE® Casting Reporter

20 TONS OF MEEHANITE CASTINGS IN THIS 500-TON RESISTANCE WELDER



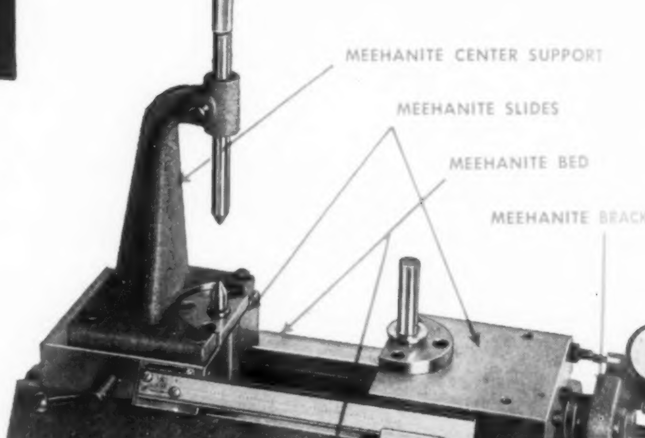
The Taylor-Winfield Corporation, Warren, Ohio, engineered and built a 500-ton resistance welder (largest of its kind in the world), for the Cleveland Pneumatic Tool Company. It has an upsetting load of 1,058,000 pounds and a broaching load of 270,000 pounds.

Taylor-Winfield engineers chose Meehanite castings as the heart of this huge welder because of their high strength, their pressure tightness, and their wearing properties. The illustration shows the vital Meehanite parts.

As The Manufacturer Says:

"Due to Meehanite Metal's close or fine grain the machining qualities are excellent and give us better finish and greater strength. Meehanite's heat-treatability gives us better rams for our press welders."

PRECISION INSTRUMENT MANUFACTURER SPECIFIES MEEHANITE CASTINGS



The George Scherr Co., Inc., New York City, manufacturers of precision measuring and testing instruments, has found that insisting upon Meehanite components in the building of their spur gear tester has resulted in greater economy and in the elimination of assembly and fitting problems.

As The Manufacturer Says:

"The production of this testing machine was engineered completely by the use of Meehanite castings. We needed hardened and ground ways in the bed and, similarly, in both slides. If we had provided these by using hardened and ground steel inserts, it would have made the production of the machine much more expensive.

"Instead, we flame-harden both the ways in the bed and the ways at the bottom of the two slides. As a result, we have no extra assembly or fitting problems, and the finishing of all the guide ways is a simple surface grinding operation."

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-5-287

WARWICK DRILL BLANKS
OF HIGH SPEED STEEL
AT MONEY-SAVING PRICES

Inch	Wire	Ground and Polished +.0002 −.0000	Centerless Ground +.0000 −.0005
	80	.42	.38
	79	.42	.38
1/64		.42	.38
	78	.42	.38
	77	.42	.38
	76	.42	.38
	75	.42	.38
	74	.42	.38
	73	.42	.38
	72	.42	.38
	71	.42	.38
	70	.42	.38
	69	.42	.38
	68	.42	.38
1/32		.42	.38
	67	.42	.38
	66	.42	.38
	65	.42	.38
	64	.42	.38
	63	.42	.38
	62	.42	.38
	61	.42	.38
	60	.16	.14
	59	.16	.14
	58	.16	.14
	57	.16	.14
	56	.16	.14
3/64		.16	.14
	55	.16	.14
	54	.16	.14
	53	.16	.14
1/16		.16	.14
	52	.16	.14
	51	.16	.14
	50	.16	.14
	49	.17	.15
	48	.17	.15
5/64		.17	.15
	47	.17	.15
	46	.17	.15
	45	.17	.15
	44	.17	.15
	43	.17	.15
	42	.18	.16
3/32		.18	.16
	41	.18	.16
	40	.18	.16
	39	.19	.17

Inch	Wire	Ground and Polished +.0002 −.0000	Centerless Ground +.0000 −.0005
	38	.19	.17
	37	.19	.17
	36	.20	.18
7/64		.21	.19
	35	.21	.19
	34	.21	.19
	33	.22	.20
	32	.22	.20
	31	.22	.20
1/8		.23	.21
	30	.24	.22
	29	.24	.22
	28	.25	.23
9/64		.25	.23
	27	.25	.23
	26	.25	.23
	25	.25	.23
	24	.28	.25
	23	.28	.25
5/32		.28	.25
	22	.28	.25
	21	.29	.26
	20	.29	.26
	19	.29	.26
	18	.30	.27
11/64		.30	.27
	17	.31	.28
	16	.31	.28
	15	.33	.30
	14	.33	.30
	13	.33	.30
3/16		.33	.30
	12	.35	.32
	11	.35	.32
	10	.35	.32
	9	.35	.32
	8	.35	.32
	7	.35	.32
13/64		.40	.36
	6	.40	.36
	5	.40	.36
	4	.40	.36
	3	.40	.36
7/32		.40	.36
	2	.41	.37
	1	.41	.37
	A	.41	.37
15/64		.41	.37
	B	.44	.40

Inch	Wire	Ground and Polished +.0002 −.0000	Centerless Ground +.0000 −.0005
	C	.44	.40
	D	.45	.41
1/4	E	.45	.41
	F	.51	.46
	G	.51	.46
17/64		.51	.46
	H	.53	.48
	I	.53	.48
	J	.53	.48
	K	.55	.50
9/32		.55	.50
	L	.60	.54
	M	.61	.55
19/64		.64	.58
	N	.64	.58
5/16		.66	.60
	O	.73	.65
	P	.73	.65
21/64		.73	.65
	Q	.79	.72
	R	.79	.72
11/32		.79	.72
	S	.86	.78
	T	.86	.78
23/64		.86	.78
	U	.92	.84
3/8		.92	.84
	V	1.00	.90
	W	1.02	.93
25/64		1.02	.93
	X	1.07	.97
	Y	1.07	.97
13/32		1.10	1.00
	Z	1.15	1.05
27/64		1.19	1.08
7/16		1.26	1.15
29/64		1.35	1.23
15/32		1.44	1.31
31/64		1.54	1.40
1/2		1.60	1.45
33/64		1.90	1.72
17/32		1.92	1.72
35/64		2.20	2.00
9/16		2.20	2.00
37/64		2.56	2.34
19/32		2.56	2.34
39/64		2.75	2.48
5/8		2.75	2.48

PRICES OF SETS (In Huot Index)

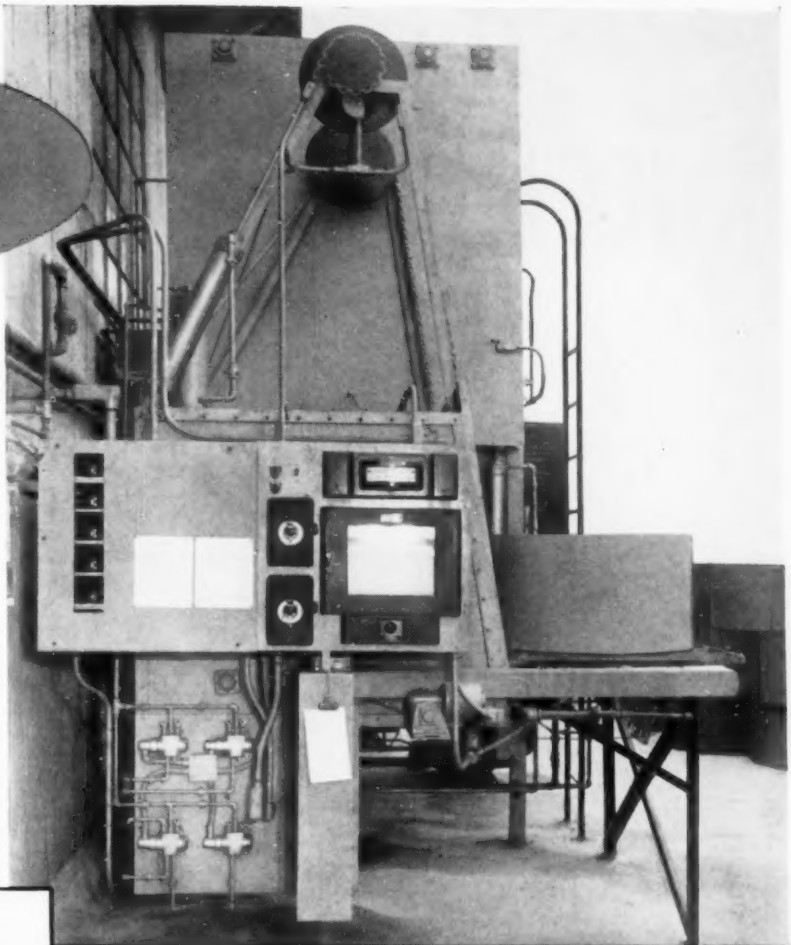
	+.0002 −.0000	+.0000 −.0005
1/16-½	$22.14	$20.29
A-Z	$20.40	$18.69
#1-60	$16.92	$15.42
All 3 Sets	$58.00	$53.00

WARWICK TWIST DRILL COMPANY

16167 Warwick Road **Detroit 19, Michigan**

6 reasons why *Modernair*

TRADEMARK



PROVENAIR
Air and Hydraulic
CYLINDERS

are easiest...

TO INSTALL
and
MAINTAIN

AUTOMATION WITH PROVENAIR CYLINDERS . . . California-Doran Heat Treating Co., Los Angeles, uses 4" bore PROVENAIR cylinders and MODERNAIR CV series solenoid-operated valves to operate furnace doors, move parts through fully-automatic heat treat cycle.

1. Interchangeable mountings—your choice of brackets, flange, or clevis-type swivel.
2. Heads can be rotated 360° to simplify piping.
3. Standard "O" ring seals used throughout—easy to obtain and replace.
4. Corrosion resistant; designed for safe, reliable operation on air, water or oil hydraulic systems to 400 p.s.i. in 2" and 3" bores, 200 p.s.i. in 4" and 6" bores.
5. Available in 2", 3", 4" and 6" bore sizes, any practical stroke length, in non-cushion or cushion (factory set or adjustable) types.
6. Prompt delivery of cylinders or parts from factory or dealer stocks in principal cities.

New Catalog

gives complete data and prices on MODERNAIR's full line of cylinders, valves, packaged fluid power devices. Write today for your free copy.

Modernair CORPORATION

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Announcing

KENNAMETAL* GRADE

K21

the new, superior General Purpose steel-cutting carbide

K21 . . . the new Kennametal General Purpose steel-cutting grade . . . is out-performing all other carbides in its field, even K2S, the leader of all General Purpose grades in the carbide industry for over a decade. Its superior performance is due to high edge strength, combined with superior wear qualities and resistance to cratering. K21 was created to help get highest productivity from today's high-speed machines, yet, due to its range, it does an excellent job on older, slower-speed machines.

Naturally, K21 has been thoroughly tested. It has demonstrated great versatility on planing, turning, boring, plunging, and interrupted cutting . . . on such materials as forgings, sandy castings, centrifugal castings, plate, bar stock, and weldments.

K21 simplifies the problem of grade selection since it performs in all three groups—general steel-cutting, heavy roughing, and finishing. It is ideal for machining the newer high tensile strength steels, has high resistance to thermal shock, and is less susceptible to grinding cracks.

Why not try Kennametal Grade K21 *now!* It is available from stock in the most popular blanks, tools and inserts. Order today. KENNAMETAL INC., Latrobe, Pennsylvania.

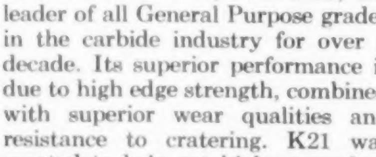
K21 OFFERS

- Superior Wear Qualities
- Exceptionally High Edge Strength
- High Resistance to Thermal Shock

K21 is designed for cutting stainless steels, nickel steels, heat-resistant alloys, and high tensile alloy steels.

*Registered Trademark

5560

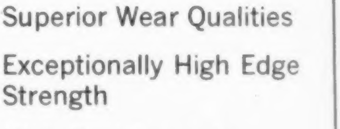


MINING, METAL AND WOODWORKING TOOLS

WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND KENNAMETAL

. . . *Partners in Progress*



ABRASION, CORROSION-RESISTANT PARTS

PERCUSSION AND IMPACT PARTS

For Fast Set Up and Positive Accuracy

Use the *DIMENSIONAIR*

TRY THE DIMENSIONAIR . . . and see for yourself its superior features.

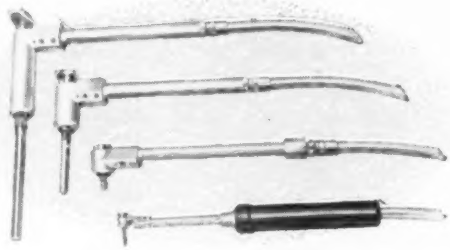
Set in *less than ten seconds* — no time wasted balancing air pressures.

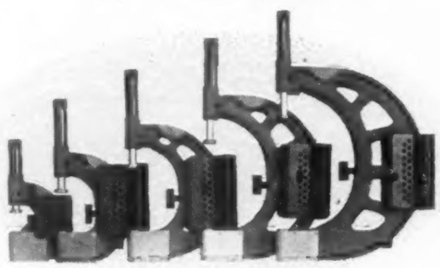
The only air gage made to a definite predetermined accuracy.

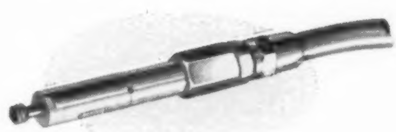
The only air gage accurate enough to have a calibrated scale. That's why it can be set to one master.

Its calibration is *built into* the gage. You don't read approximate graduations between tolerances.

Don't take our word for it—or anybody's—take your own. Try it, compare it, and use it. Ask us for a chance to operate one.







Dimensionair Accessories also have outstanding advantages

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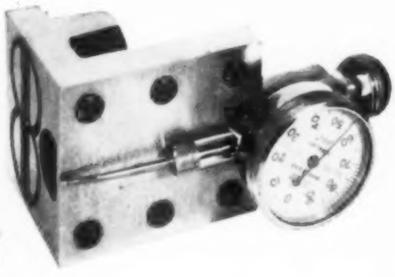

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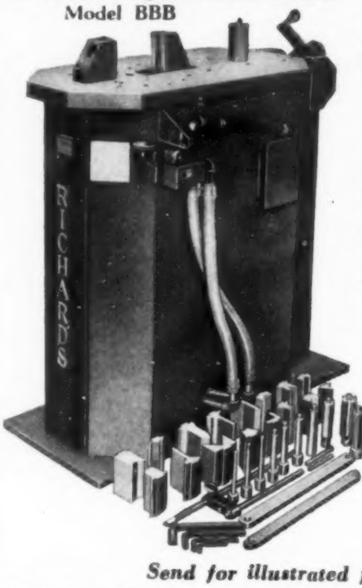

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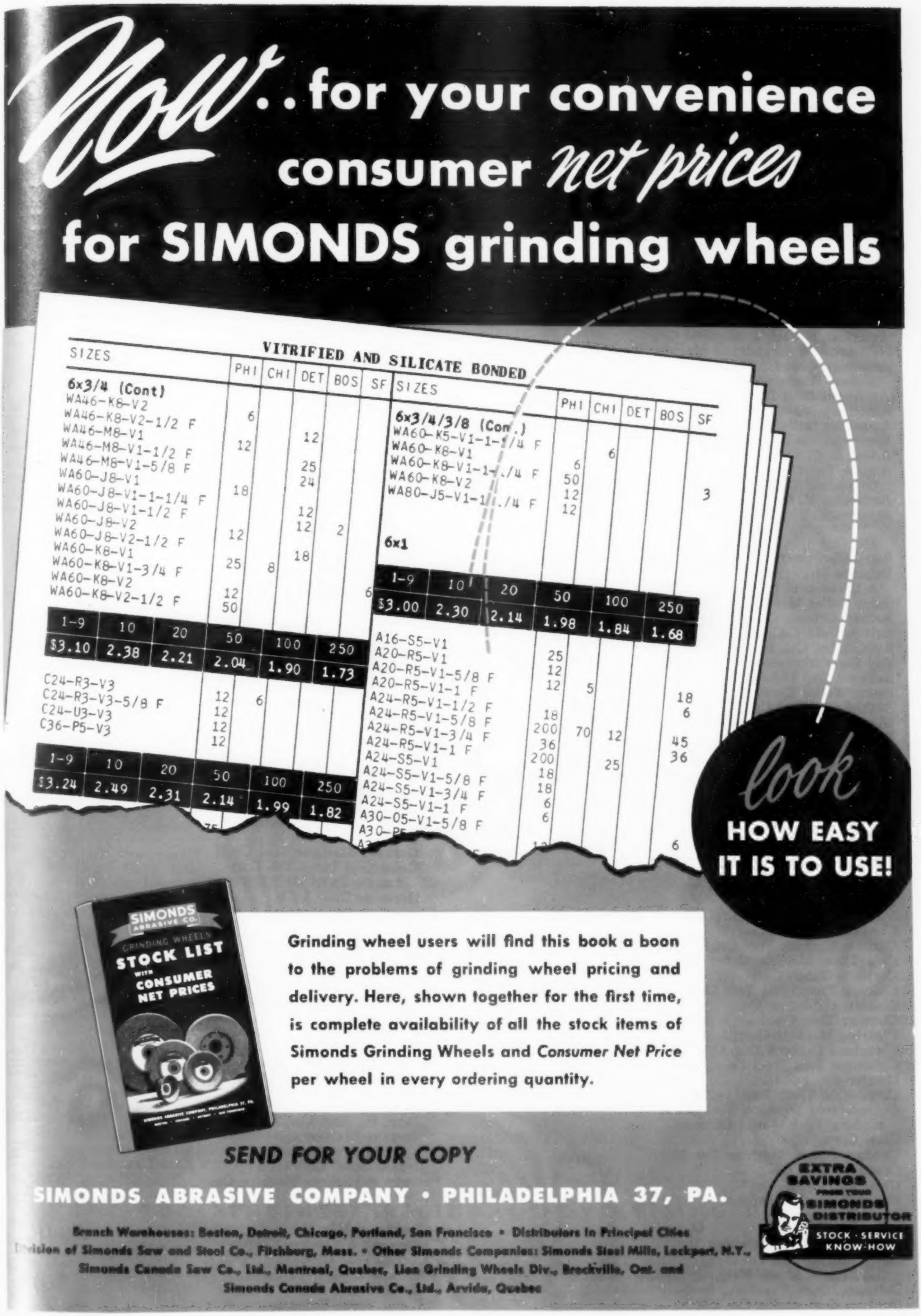
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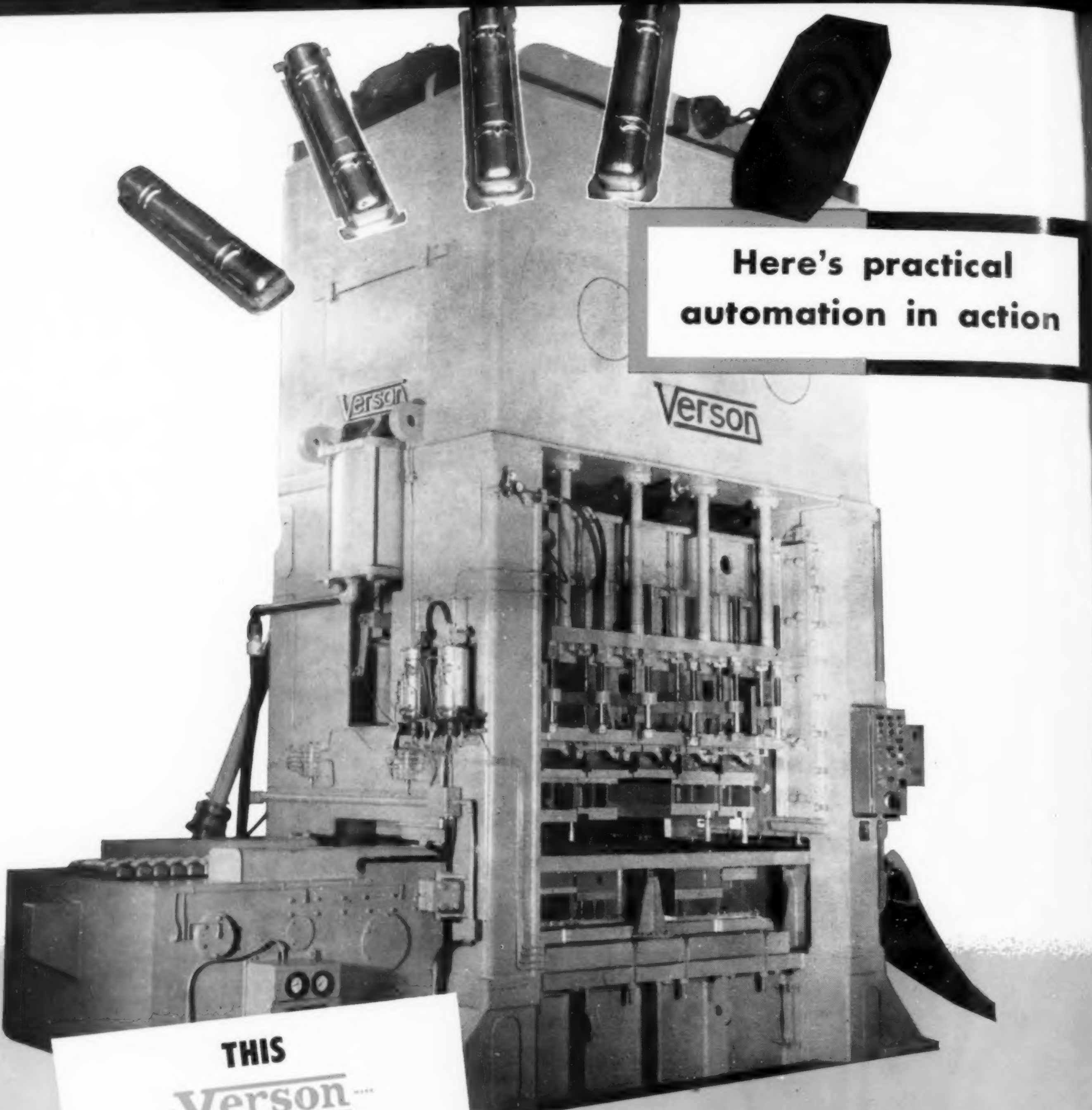
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